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This study's purposes were to determine the predictive validity of the Washington Pre-College Test (WPCT) for 16 introductory courses at Yakima Valley College, to demonstrate the importance of a coordinated program of institutional research, and to help the WPCT program gather more data on the students. The predictor intercorrelational table and the predictor criterion matrix both showed that a differential weighting favoring cumulative high school GPA's and verbal subtests could be used to predict academic behavior reasonably accurately. The specific GPA's were the best predictors; the quantitative skills were the least useful. Mechanical Reasoning, Spatial Ability, Reading Speed, Age, and Sex were unique variables. Multiple regression equations, coefficients of multiple correlation, and percentage of accountable variance by each contributing predictor variable were computed for each criterion area. The percentile tables showed females higher in all measured high school areas and verbal subtest scores, with males higher in quantitative measures. The total group table coincided with the male table; the college total table was almost identical with a junior college table, but different from an all-college table consisting mainly of 4-year students. The findings suggest the test battery is predicting student college performance reasonably well. A locally constructed battery could possibly increase the validity, but not enough to warrant the time and money spent. (HH)

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A STUDY OF THE PREDICTIVE VALIDITY OF THE WASHINGTON PRE-COLLEGE TEST FOR INTRODUCTORY COURSES AT YAKIMA VALLEY COLLEGE

by

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This study was supported by
Washington Pre-College Testing Program
Seattle, Washington
February 1968

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I wish to gratefully acknowledge the assistance given to me by many people in the completion of this project. To identify each person individually would take an extended amount of time and space, but I am certain each of them knows that I am very appreciative of their efforts.

It is, however, necessary and appropriate to extend special recognition to several groups and individuals. First, thanks to the Washington Pre-College Testing Program for the financial and technical support. Specifically I wish to acknowledge the assistance of Dr. Thomas Langen and Mr. Renny Greenmum in performing the calculations and helping interpret their significance.

This study could not have been completed without the total support of Yakima Valley College. The administration of the college was most generous in allowing the freedom and flexibility to pursue this project and faculty colleagues provided much needed encouragement and assistance. Mr. Paul Aspevig gave a great deal of help in designing the data layout and gathering the criterion information to be used in the calculation. Mr. Robert Seamons and Mr. Al Perry also devoted much of their time to program our college computer and provide some of the statistics included in this report.

I cannot express my appreciation in words alone to the members of the registrar's staff and the other secretaries and student assistants who actually carried on the task of hand-gathering the information and helping me prepare it for presentation. They all worked under pressure to meet deadlines and carried out their tasks with a high degree of accuracy.

In view of all of these personal contributions I must say that whatever credit and benefit may be gained from these findings should be shared by all those involved.

Gary A. Rice

RESEARCH ABSTRACT

A STUDY OF THE PREDICTIVE VALIDITY OF THE WASHINGTON PRE-COLLEGE TEST FOR INTRODUCTORY COURSES AT YAKIMA VALLEY COLLEGE

February 1968

The study attempted to accomplish a threefold purpose: (1) determine the predictive validity of the W.P.C.T. for 16 introductory courses at Y.V.C., (2) demonstrate the potential of and need for a coordinated program of institutional research, and (3) assist the W.P.C.T.P. to gather more information about the junior college student.

The predictor intercorrelation table and predictor criterion matrix both indicated that a differential weighting favoring high school cumulative averages and verbal subtests could be used to predict academic behavior with reasonable accuracy. The specific high school cumulative averages proved to be the best predictors while the quantitative skills showed the least relationship to academic success. Mechanical Reasoning, Spatial Ability, Reading Speed, Age and Sex seemed to be unique variables.

Multiple regression equations, coefficients of multiple correlation, and percentage of accountable variance by each contributing predictor variable were computed for each criterion area.

The percentile tables generated on Y.V.C. students showed the females consistently higher in all measured high school areas and verbal subtest scores with males higher in quantitative measures. The total group table coincided with the male table. The Y.V.C. total table was almost identical with a community college table but different from an all-college table consisting mainly of four-year students.

The findings suggested that the W.P.C.T. test battery is reasonably predicting student performance at Y.V.C. A locally constructed battery could possibly enhance the predictive validity, but the increment of increase would not warrent the expenditure in time, facilities and money.

Gary A. Rice

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A STUDY OF THE PREDICTIVE VALIDITY OF THE WASHINGTON PRE-COLLEGE TEST FOR INTRODUCTORY COURSES AT YAKIMG VALLEY COLLEGE

CHAPTER I

INTRODUCTION

The public institutions of higher education in the State of Washington currently utilize, in varying capacities, a state-wide testing program, the Washington Pre-College Testing Program (W.P.C.T.P.). An understanding of how the program developed to its current status and the role it plays in assisting the college-bound student to make realistic academic decisions based on the best empirical evidence available is germane to this paper and will be presented in this chapter.

History and Organization Structure of the W.P.C.T.P.[1]

The W.P.C.T.P. is a unique and extensive state-wide testing program in Washington. The program originated in the admissions research work of Dr. August Dvorak and the psychometric research work of Dr. Paul Horst at the University of Washington. Dr. Horst designed the theoretical model of differential prediction which underlies the development of the program. His method proved quite successful at the University and several other colleges throughout the state then determined that the test results and grade predictions were equally valid for their entering freshmen. The high schools also became interested in the Differential Guidance Program and, because of the expanding interest, procedures were instigated to develop the test battery into an instrument which would be valid on a state-wide basis. The W.P.C.T.P. came into being in January, 1960, as a cooperative testing effort of the colleges and high schools within the state.

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[1] Gary A. Rice. "The Washington Pre-College Testing Program and the Community Colleges", presentation at National A.P.G.A. Convention, Detroit, April 1968.

The program has grown at a very rapid rate since its inception having tested approximately 34,000 high school seniors and college freshmen during 1966-67 alone. However, this program despite its size, has constantly emphasized its desire to provide only a supplement to an effective guidance and counseling program at all levels of secondary and higher education rather than dominate any such program. With the full recognition of the role of the test battery and its interpretation the colleges and high schools can utilize one instrument and its resultant data report for multiple uses. This would then enable each institution to avoid the necessity of developing its own costly and burdensome testing program. Also the great duplication of effort and variety of norm groups which would result from such a multiplicity of individual programs could be circumvented. Thus the W.P.C.T.P. can serve a variety of functions among the colleges and universities of the state in addition to its usefulness to the high school counselor.

Although the test battery originated at the University of Washington and the normative data was derived from this population the test scores and grade predictions proved valid and reliable at other four-year institutions. Two dissertations have shown that the predictions were valid at Seattle University[2] and Western Washington State College[3], and both authors pointed out that it was not necessary to develop separate regression formulas for these institutions. These and other local studies supported the contention that the battery can accurately predict at the four-year level in Washington.

The Community Colleges and the W.P.C.T.P.

The state is witnessing tremendous growth and expansion among the two-year community and junior colleges. In fact the community colleges have grown more in proportional size and curriculum than any other institution of higher education. This condition is true not only in Washington but in most of the western states. Currently there are twenty-two community colleges in existence in Washington, three having opened their doors for the first time in the fall of 1967.

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[2] Herbert Reas. "A Follow-Up Study of the Washington Pre-College Differential Guidance Tests at Seattle University." Dissertation, University of Washington, 1962.

[3] James Lounsberry. "An Evaluation of the Accuracy of the Differential Prediction Test Battery in Predicting Grades for Students at Western Washington State College." Dissertation, University of Washington, 1962.

These two-year colleges serve a very unique but necessary function in education. As the amount of knowledge continues to increase society is demanding more of education to discover and transmit this ever-changing knowledge and produce people who are trained to utilize their learning potential. This situation is producing some very interesting paradoxes, however, since the increasing complexity of knowledge requires increased time to prepare the individual for any given profession and more rigorous requirements must be met to gain admission to these training programs. This latter condition means that less people are capable of initially qualifying for entrance but the institutions of society are demanding more trained people and higher and higher levels of competence for those they employ. Thus the law of supply and demand greatly affects the programs of the universities. The current trend seems to be for the universities to concentrate their efforts and competent faculty at the upper division and graduate levels and raise their entrance requirements to insure that those who enter have a high probability of success. Therefore the vast majority of college-bound youth are faced with meeting very high entrance standards and having some sophisticated learning skills. These requirements are inducing a large number of students to enter the two-year colleges to begin their college education with plans to transfer to a four-year school after completion of their basic requirements. Other factors besides the one stated above which influence the decision to attend a community or junior college are finances, course deficiencies, smaller class size, and more individualized counseling and instruction to acquire basic learning skills and emotional maturity. The net result of this combination of factors is a great influx of students at the community colleges of Washington. This surge of enrollment accompanied with the state law requiring the community colleges to have an open-door admissions policy produces some unique problems. These colleges are faced with a wide continuum of ability levels and the majority of students are not emotionally or motivationally ready to cope with college material. Also most entering students have been previously conditioned by a variety of social institutions to think only in terms of an academic transfer program and they tend to ignore or minimize the value of many available vocational-technical programs. This observation is not made to imply that vocational-technical programs are inferior to academic transfer programs. The study[4] conducted by Drs. Clifford and Patricia Lunneborg concluded that the current W.P.C.T. predictor variables predict as well in the vocational-technical areas as in the college transfer course areas. Apparently the same skills are necessary for successful performance in both areas.

These and many other related problems are forcing the community colleges to develop techniques to properly place students into programs tailored to their specific needs. Increasingly the two-year colleges are utilizing the W.P.C.T. results and the program itself to provide some assistance in this area. A survey of the uses of the W.P.C.T. by all state-supported and private colleges and universities was conducted in 1964 and a follow-up was made in 1967 (Survey of W.P.C.T. uses - Rice). The results showed that the two-year colleges were making the greatest proportional use of the test results and the predominant use was for sectioning and placement.

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[4] Dr. Clifford Lunneborg and Dr. Patricia Lunneborg. "Predicting Community College Vocational Criteria with Traditional Academic Variables." Bureau of Testing Project No. 366-500, University of Washington, March 1967.

The fact that the test battery was originally designed for four-year colleges and normative data was based on a highly select population raises some serious questions about using the same data to predict the behavior of junior college and community college students. The assumption has to be made that the two populations are the same before the data can be said to have equal validity for both. The accuracy of that assumption can be questioned when referring to the 2.5 high school grade point average as a minimum requirement to enter the university vs. the open door policy of the community colleges which must even allow entrance to those students finishing high school by social promotion.

A study conducted by Batie[5] in 1965 involved ten community colleges in a comparison of predicted and achieved grades in thirty-two disciplines. A comparison of correlation coefficients with those obtained at the University of Washington disclosed that the difference between the two was .06 or less in twenty-two of the thirty-two areas. In the remaining ten areas four correlation coefficients were found to be higher for the community colleges than for the university. Nevertheless the question of whether a significant difference exists between the two-year colleges and the four-year colleges and universities still persists. A related question is whether there is a significant difference between student populations of the Washington community and junior colleges.

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[5] William Batie. "A Study of the Achievement of Washington State Community College Students Compared with Their Performance on the Washington Pre-College Test." Study supported by the W.P.C.T.P., January 1965.

Purposes of the Study

Several broad objectives were involved in the conception and development of this project. An understanding of these goals is necessary to appreciate the need to obtain some tentative answers to some of the questions which this study will explore.

First there is an acute awareness that the community colleges in Washington are in their infancy with regard to a definition of the role(s) and the function they are to perform. A multiplicity of parameters are being discovered which demand consideration and action. These include enrollment projections, budget and finance, long-range planning, student characteristics and needs, academic and vocational-technical offerings, etc., to cite a few examples. Dr. John Segar[6] noted that the college is forced to be sensitive to the needs of several seemingly divergent groups: (1) The high schools, (2) The colleges and universities, and (3) The community served by the college. In addition to an assessment of the effect these groups have on the development of institutional objectives the college needs to be aware of its impact on these groups, especially the latter. Three questions need to be frankly asked by a college: (1) Where are we going? (2) How are we doing? (3) Why are we doing it? Because of the current inability to provide definitive answers to these questions the colleges are forced to make many arbitrary decisions and probability is thus increased that these decisions may be wrong.

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[6] Dr. John Segar. "The Concept of Institutional Research." Presentation at the annual meeting of Northwest Association of Junior Colleges, Portland, December 1967.

The lack of empirical knowledge to make decisions leads to the second major purpose of the study. There is a definite need to develop a position and program of institutional research at the junior college level. Hopefully this study will demonstrate that a program of institutional research at this level can provide information upon which more objective decisions may be made.

The Suver[7] report has identified many problem areas of common concern to the community colleges of Washington and indicated a need for inter- and intra- college cooperation to attempt to locate some solutions. The cooperative efforts of those persons at each college who desire to combine their abilities and talents to seek answers is one of the first priorities which must be sought. This study is a first small step at one institution to begin this search.

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[7] J. Allen Suver. "Problems and Needs of Washington Community Colleges: An Exploratory Survey of Important Research Areas." Occasional Paper #2, Center for the Development of Community College Education, University of Washington, June 1967.

The two broad objectives cited earlier formed the basis for this particular study since the fundamental task of any institutional research program is to locate the institution at its present level and develop guidelines for proceeding from that point. Thus the first task of the college is to define its goals in behavioral terms and then locate the data to evaluate performance toward these goals.

As a pragmatic first step in a limited area of defining the college in its current position this study is attempting to take the grades students have earned in sixteen introductory courses at Yakima Valley College and relating it to the data provided by the W.P.C.T.P. as part of the Y.V.C. admissions requirements. Within this context this study will address itself to two questions: (1) How well do the test results function to predict academic performance in the criterion areas at Yakima Valley College and (2) Does a statistically significant difference exist between the test's ability to predict at Y.V.C. vs. the University of Washington.

Part of the study will involve an analysis of the predictor criterion matrix to see which variables provide the best measures for estimating successful performance in each of the sixteen criterion areas. A predictor intercorrelation matrix will also be presented as will a criterion intercorrelation matrix.

A second phase of the study will involve the calculation and presentation of a regression equation expressed in standard score (Beta) and raw score (b) form for each criterion area. In addition, the corrected multiple coefficient of correlation, corrected multiple coefficient of determination and percentage of variance contributed by each variable in each criterion area will be computed.

If the data lends itself to the proper conditions and assumptions an attempt will be made to determine if a statistically significant difference exists between the data reported by the W.P.C.T.P. as part of its current processing procedure and the data obtained by the study. If the difference is not found to be significantly different then there is reason to use those equations already designed by the program and based on a large number of cases to enhance their predictive accuracy. If, however, there is a statistically significant difference and the sample size is large enough to infer reliability then consideration could be given to develop separate equations based on a Yakima Valley College population.

The third phase of the study will consist of the development of percentile tables in standard score form for male, female, and total group based on a Yakima Valley College norm group. A comparison will also be made between the percentile tables generated by the data of this study and the percentile tables for all college students and community college students which appear in the 1967-68 W.P.C.T.P. Student Instruction Booklet.

Sources of Data and Methods of Research

After a delineation of the purpose for the study and the definition of study parameters, the next task was to decide what data would be needed and what statistics should be computed.

The first determination was the selection of criterion areas to be included. The decision was made to limit the criterion areas to the introductory courses with the exceptions of both Intermediate and College Algebra and Introduction to Business and Principles of Accounting. These exceptions were included because the number of students involved in each area was sufficient to attach some degree of significance to the findings, and one course was not a prerequisite for entering the other.

It was finally decided to include sixteen introductory courses which were drawn from each of the seven college transfer or academic curriculum divisions: Business Administration, Creative Arts, Language and Literature, Natural Sciences, Physical Education, Physical Sciences, and Social Sciences. In addition to selecting criterion areas from each academic division, the particular courses which were chosen were selected on the basis of greatest enrollment to help insure greater reliability and validity in the statistics. The sixteen criterion areas chosen were: Art Appreciation, General Biology, Introduction to Business, Principles of Accounting, Inorganic Chemistry, Economic Geography, Introduction to Education, College English, Personal Health, History of the Pacific Northwest, Intermediate Algebra, College Algebra, Introduction to Philosophy, Introduction to Psychology, Introduction to Sociology, and Introduction to Public Speaking.

The study was designed to include all students at Yakima Valley College who had taken one or more of the sixteen introductory courses during either Fall, Winter or Spring Quarter of the 1966-67 school year. It was recognized that many students would be involved in each quarter as long as they were enrolled in one of the criterion areas. For this reason the original design required a separation by quarter to see how large this factor might be. However, after the data was separated in this manner it was noted that the number of cases was so small as to make any derived statistics meaningless so the decision was made to combine the three quarters to obtain more valid data.

After the decisions cited above were reached the W.P.C.T.P. was contacted about the possibility of assistance in computing the requested statistics and supplying technical advice. The questions were referred to the W.P.C.T. Research Committee and a research proposal was prepared and submitted to them. This body met to act on the proposal and generously granted an allocation of funds in the amount of $750.00 to pay for the cost of computer time and preparation of data. In addition, Dr. Thomas Langen, Mr. Renny Greenmum and the other members of the program extended an offer to assist with the many technical aspects of the study.

After the assistance of the W.P.C.T.P. was secured the next step was to determine the actual form the data should be in before submission for computation. Since the W.P.C.T.P. central office had a master file of every individual who had taken the test from the program's inception it was necessary and advisable to prepare the Y.V.C. criterion cards to coincide with their data format. The card would not have to contain each of the test scores and high school grade averages since this information was already available on data cards at the central office. The only information necessary would be the student's W.P.C.T. identification number so the computer could draw and merge the data from storage. Therefore, seven columns on each criterion card were allocated for this identification number.

A small computer program was written at Y.V.C. to extract the data for any student who had taken any of the criterion courses during fall, winter or spring quarter of 1966-67 and also indicate the grade the student earned.

The following data was then entered on the criterion card in a format designed to be compatable with the W.P.C.T. master card layout: Quarter code, W.P.C.T. student identification number, sex, Yakima Valley College student identification number and first name, middle initial, and last name. If the student enrolled and completed one or more of the sixteen criterion courses during any one or more of the quarters included in the study, the earned grade was implanted in a designated column. The grade was coded in the following manner (A-4, B-3, C-2, D-1, F, WF, AWF-0). Non-graded withdrawals and audits were not included since they did not influence the student's college grade point average. However, grades earned in repeat courses were included since they did enter into the final g.p.a. calculation.

The specially designed criterion data cards were submitted to the W.P.C.T.P. central office with the request that the following calculations be performed and/or information provided:

1. A predictor intercorrelation matrix.
2. A predictor-criterion correlation matrix.
3. A criterion intercorrelation matrix.
4. The mean, standard deviation, and number of students involved for each predictor and criterion variable.
5. A coefficient of multiple correlation (corrected), and coefficient of multiple determination between the predictor variables and each criterion course.
6. The regression weights in standard score form (Beta weights) and raw score form (b weights) and the percentage of variance accounted for by each variable in the regression equation for each criterion area.
7. The generation of Yakima Valley College percentile norms in standard score form for male, female and total population.
8. If the data meets the conditions necessary for its computation, tests for the existence of a statistically significant difference between the Beta weight values computed for this study and their counterparts now generated by the W.P.C.T.P. Hopefully this will indicate the degree of confidence Yakima Valley College can place in the test scores now provided by the program.

The W.P.C.T.P. promptly performed all of the calculations requested and even supplied additional data which they had previously built into their computer program such as cumulative frequency, cumulative percentage, mean, median, mode, range, semi-interquartile range and skewness. The data was returned to Yakima Valley College for interpretation and this paper represents an analysis of the findings.

Summary

Surveys and informal communication among personnel at the junior college level indicated that the Washington Pre-College Test was being utilized in a variety of ways but the haunting question confronting all users was whether the results were really applicable to a junior college population. This situation resulted from the fact that the program utilized a norm group drawn primarily from the University of Washington.

In all fairness to the program, however, it should be noted that they have become cognizant of the expanding two-year colleges and the ramifications of their existance and function and have taken steps to incorporate data from these community and junior colleges. Such steps include the development of prediction equations in seven vocational-technical areas and the plan to expand their predictions to more areas once data is available, development of two-year college percentile tables based on data supplied by six community colleges in the state, several other W.P.C.T.P. sponsored and conducted projects of interest to the two-year colleges currently under way, and their encouragement of individual college projects to promote an interest in utilizing research methods to seek answers.

This paper thus represents an attempt to accomplish a three-fold purpose: (1) to determine the predictive validity of the W.P.C.T. for introductory courses at Yakima Valley College, (2) demonstrate the potential of and need for a coordinated program of institutional research at Y.V.C., and (3) assist the W.P.C.T.P. to gather more information about the junior college student.

RELATED RESEARCH

CHAPTER II

As stated earlier in Chapter I, the community colleges of Washington as well as other parts of the United States are just beginning to be recognized as unique but vital institutions of higher education. Because of this fact they are growing at a tremendous rate but, in many cases, this growth has not necessarily been anticipated and thoroughly planned. There are several reasons for the apparent lack of foresight. One is that the colleges have not had tangible guidelines upon which to base their programs. A second very important reason is the lack of an organized and systematic attempt to locate the institution at its present state and define its areas of expansion and development. The community colleges are just now beginning to ask some penetrating questions which require some answers and this necessitates setting up some formal procedures to seek data and provide some tentative solutions. This has not been done in any organized way to date resulting in a paucity of surveys and research projects devoted to the community college problems. To cite a specific example of a deficit area, organized research to ascertain ways of predicting student behavior so that student abilities and needs could be identified is sadly lacking. A related concern is the problem of proper placement of a student into a course or program tailored to fit his needs. Even acknowledging the lack of available information, however, it is necessary to search the literature to locate relevant studies and information concerning predictability of community college student potential which will provide a reference point for the findings of this project.

Reference has already been made to a community college study by William Batie[1]. The results of the study disclosed that a correlation coefficient difference of .06 or less between predicted and achieved grades existed for twenty-two of thirty-two course areas and four of the remaining ten areas actually had higher correlation coefficients for the community colleges than for the University of Washington. These results certainly would not be anticipated on an a priori basis.

Drs. Clifford and Patricia Lunneborg conducted a recent study[2], also referred to earlier, and concluded that the current predictors of the W.P.C.T. test battery predict success in the vocational-technical areas of the junior colleges almost as well as they predict college transfer course areas.

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[1] William Batie. "A Study of the Achievement of Washington State Community College Students Compared with Their Performance on the Washington Pre-College Test." Study supported by the W.P.C.T.P., January 1965.

[2] Dr. Clifford Lunneborg and Dr. Patricia Lunneborg. "Predicting Community College Vocational Criteria with Traditional Academic Variables." Bureau of Testing Project No. 366-500, University of Washington, March 1967.

In an unpublished study submitted to the W.P.C.T.P. central office, Gary Rice[3] obtained a correlation coefficient of .79 between predicted and obtained grades in introductory psychology. The study involved the total population of students (300) enrolled in Introductory Psychology during the Fall Quarter 1965-66 at Yakima Valley College.

Drs. Clifford and Patricia Lunneborg began two studies related to the community colleges in April 1967, under the sponsorship of the W.P.C.T.P. The first one[4] was designed to develop community college percentile tables for males, females, and a total sample of students who entered Clark, Everett, Highline, Lower Columbia, Skagit Valley and Yakima Valley Colleges, between 1963 and 1965. The total sample numbered 8,900, with 5,600 males and 3,300 females. The percentile table for the total sample has now been included in the 1967-68 W.P.C.T.P. Student Instruction Booklet for distribution to high school seniors and college freshmen throughout the state. This table will be referred to in Chapter V of this report and a copy of it may be seen in Appendix B.

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[3] Gary A. Rice. "Predicted vs. Obtained Grades in Introductory Psychology at Yakima Valley College." Yakima Valley College, Associate Director of Institutional Research and Testing, Yakima Valley College.

[4] Dr. Clifford Lunneborg and Dr. Patricia Lunneborg. "Community College Norms 1963-65 for the Washington Pre-College (W.P.C.) Test Battery and High School Grades." Bureau of Testing Project No. 366-520, University of Washington, April 1967.

The second study[5] grew out of the recognition by the W.P.C.T.P. central office that the growing enrollments and utilization of the test results by the two-year colleges necessitated an expansion of the general academic guidance battery so it would be functional for the community colleges. This study was part of the program's continuing evaluation of the predictor variables currently in use and the testing of experimental variables to determine the kind and amount of unique contribution they make toward differential prediction. It was determined from data gathered to the date of this study that two employment aptitude tests, G.A.T.B. tool and form matching, were unique enough and contributed enough new variance to the established battery to warrant the accumulation of additional criterion data. This data is currently being gathered.

The problems of testing and prediction in the community colleges are not novel or unique to Washington. Other states are also facing these questions and searching for answers.

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[5] Drs. Clifford and Patricia Lunneborg. "Uniqueness of Selected Employment Aptitude Tests to a General Academic Guidance Battery." Bureau of Testing Project No. 366-590, University of Washington, April 1967.

An evaluation and advisory service field studies report was prepared by Dean Seibel[6] and published by Educational Testing Service. The study was based on a selected sample of sixty-three public and private junior colleges in eighteen states. The findings disclosed that the needs that seemed of most concern to public junior colleges were needs for differential guidance tests, subject-matter achievement tests, more research on tests, in-service measurement training for faculty, and the need to make test results more useful. The report concluded:

> It seems evident that standardized tests are widely and extensively used in both public and independent junior colleges. Although the colleges experience some problems in using the tests and are somewhat critical of them, it seems reasonable to conclude that standardized tests are meeting many of the junior college evaluation needs. Generally, the tests are used successfully in admission, guidance, placement and, to some extent, research. They are used most intensively during an initial period extending through the first semester and very little thereafter.
>
> But, apparently the situation is far from satisfactory. Aside from the problems such as lack of appropriate norms, difficulty in locating or selecting appropriate tests, and inadequate use of test information, the junior colleges feel that there is need for new kinds of tests and for tests to meet new kinds of measurement objectives.

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[6] Dean Seibel. "Testing Practices and Problems in Junior Colleges--A Survey." Field Studies Report FSR-2, Educational Testing Service, Princeton, New Jersey, September 1966.

This awareness of the need to define the problem areas of common concern to the community colleges and the corollary of developing new techniques[7] to approach these problems is a very real concern to the two-year institutions. The junior colleges of California have produced a document which attempts to identify problem areas and the State of Washington has completed the same type of survey in the Suver[8] report which defined some thirty-eight areas where community colleges sought information. These thirty-eight areas could be combined into three large categories of need: long-range planning, student needs, and faculty concerns. Much more research is needed in all of these areas and the community colleges are just now beginning to embark upon some projects which will shed some light on these ill-defined questions.

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[7] John E. Dobbin and William W. Turnbull. "The Need for New Appraisal Techniques in Junior Colleges." Reprint from Junior College Student Personnel Programs (A Report to Carnegie Corporation), American Association of Junior Colleges, Washington, D. C., November 1965.

[8] J. Allen Suver. "Problems and Needs of Washington Community Colleges: An Exploratory Survey of Important Research Areas." Occasional Paper #2, Center for the Development of Community College Education, University of Washington, June 1967.

One particularly pressing need for the community colleges is knowledge of student characteristics at each institution. Unless the college has some awareness of the population with which it is dealing it is meaningless to attempt to predict what behavior could be expected. The State Office of Public Instruction (Allan W. Metcalf and Ray E. Jongeward)[9] prepared a statewide composite of community college student characteristics. Approximately three-fourths of the two thousand students included in the study were "Academic Students" i.e., their enrollments were predominantly in academic transfer courses. The remaining number were enrolled in approved vocational courses with the exception of 48 enrollees in courses considered as "Adult Education" or "Community Service". The median age of full-time students was 19.5 for males and 19.0 for females. The median age for part-time students was 25.6 for males and 31.9 for females. The vast majority of students were legal residents of the state.

> In general the enrollment patterns show that somewhat over half ... enrollees are full-time "Academic Students". As one might expect, "Vocational Students" tend to be older and more likely to attend on a part-time basis. The proportion of women tends to be greater

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[9] Louis Bruno, "Community College Student Characteristics." Research Report 01-05, Office of State Superintendent of Public Instruction, Olympia, April 1965.

> in the part-time and the vocational programs as well as in the higher age groups. The young, recent high school graduates tend to be in academic programs with declared intent to attend four-year colleges in the future.

This composite superficially appears to describe the gross characteristics of Yakima Valley College students. However, the fact that it does raises some pressing questions; the majority of high school students entering Y.V.C. state their intention to transfer but the feedback from the four-year institutions disclose that only a small percentage actually reach the upper division level. The question then arises as to the fate of the vast majority who just seem to disappear. Besides the necessity for a follow-up of these people it may be possible to assist this undefined majority to a greater degree if they can be identified and initially directed to programs where their probability for success is greater.

The desire to know the academic potential and actual performance of junior college students is so great that it has prompted the national testing programs to commit their staff and facilities to this endeavor. Dean Seibel, Director of the Evaluation and Advisory Service for Educational Testing Service[10] published a field studies report on the academic ability and performance of junior college students. This report was part of a large research project supported by the College Entrance Examination Board. The study involved a selected sample of nearly 10,000 seniors in 147 high schools who took the College Board Preliminary Scholastic Aptitude test in the fall of 1960. A sub-sample of about 2,500 seniors was followed through the first year after graduation from high school. The students in the sub-sample who enrolled in college went to 439 different four-year colleges and 67 different two-year colleges. The findings indicated that the proportion of students completing the freshman year in good standing is smaller among junior colleges (61 per cent) than among students enrolled in four-year institutions (78 per cent). The proportion of students dismissed for academic reasons is approximately the same for the two levels but the proportion on probation is nearly twice as great for junior college freshmen. The author felt this indicated that although the junior college must take punitive academic measures against a higher proportion of students they tend to be less severe in these measures and more disposed to give students a "second chance".

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[10] Dean Seibel. "A Study of the Academic Ability and Performance of Junior College Students." Field Studies Report--FSR-1, Educational Testing Service, Princeton, New Jersey, October 1965.

The ability measures indicated that the level of seniors who enrolled in junior colleges was above that of students who did not attend college, but at about the same level as the total group of high school seniors. Seniors who were successful at the first year of junior colleges were, in general, of considerably higher ability than those who experienced academic difficulty. Finally the average ability level of seniors who enrolled in four-year colleges was higher than the level of junior college students.

The American College Testing Program has also devoted a great deal of money and effort to conduct research aimed at the junior colleges. In fact, three of the A.C.T. Research Reports by Richards, Jr., Rand and Rand,[11] Richards, Jr., Rand and Rand,[12] and Hoyt and Munday [13] were devoted to a description of the junior colleges.

The first A.C.T. study was a description of 581 accredited two-year colleges. The thirty-six variables included in the study were selected on the basis of current use in characterizing institutions. After a thorough comparison of all the variables the overall finding disclosed that junior colleges are different from four-year colleges and it would not be appropriate to apply a classification scheme developed for one type of college to the other type.

The Richards, Jr., Rand and Rand report attempted to examine the geographical distribution of various junior college characteristics to determine if regional differences existed. This study was the result of the previous research project which had factor analyzed the original 36 variables into 6 categories; Cultural Affluence, Technological Specialization, Size, Age, Transfer Emphasis, and Business Orientation. The findings emphasized that stratified random sampling from each region of the country is necessary before statements about regional differences can be made. However, the results may provide clues to needs of students or of society that are not being met by existing junior colleges in any given region of the country.

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[11] James P. Richards, Jr., Lorraine M. Rand, and Leonard P. Rand. "A Description of Junior Colleges." A.C.T. Research Report No. 5, American College Testing Program, July 1965.

[12] James P. Richards, Jr., Leonard P. Rand, and Lorraine M. Rand. "Regional Differences in Junior Colleges." A.C.T. Research Report No. 9, American College Testing Program, December 1965.

[13] Donald P. Hoyt and Leo Munday. "Academic Description and Prediction in Junior Colleges." A.C.T. Research Report No. 10, American College Testing Program. February 1966.

The Hoyt and Munday report cited here had approximately the same purpose as the study produced by Seibel[10]: the academic description and prediction of academic ability and performance in junior colleges. The A.C.T. data from 85 junior colleges was compared with those for 205 four-year colleges. These junior college students, like the Seibel students, were found to be somewhat less able academically than their peers in four-year colleges. However, differences among junior colleges in academic potential were so great that the least able students in one junior college would be well above average in another.

The study also concluded that students within individual junior colleges had more diverse academic talents than was typical of students in four-year institutions. However, grade point average in both junior colleges and four-year colleges were quite similar (about a "C").

There must be other published and unpublished research studies devoted to the community and junior colleges but it is felt that the sources cited previously should demonstrate the need for studies such as this one at the Yakima Valley College. However, for the interested reader there are related project abstracts on file in the Educational Retreival Information Center (E.R.I.C.) at U.C.L.A. by Hall[14], Young[15], Jost[16], Wilson and Gelso[17], Nielson[18], and Morgenfeld[19].

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[14] Lincoln H. Hall. "Performances of Average Students in a Junior College and in Four-Year Institutions." California Bureau of Pupil Services, Sacramento, E.R.I.C. No. JC670-820.

[15] Edwin P. Young. "Interrelationships Between Selected Psychological and Academic Measures in an Experimental Program for "Low Ability Students". Los Angeles City College, E.R.I.C. No. JC660-047.

[16] Erwin Jost. "High Verbal Aptitude and Grade Achievement, A Study of the Grade Achievement of 200 First-Semester College of San Mateo Freshmen Who Ranked High in Verbal Aptitude as Measured by the School and College Ability Tests and Cooperative English Tests." College of San Mateo, E.R.I.C. No. JC660-083.

[17] Ray Wilson and Charles J. Gelso. "The Prediction of Grades in College Algebra--A Continuation and Extension. "South George College, Douglas, E.R.I.C. No. JC670-436.

[18] Marjorie L. Nielson. "A Supplemental Guidance Manual Based on Institutional Research." Everett Junior College, Washington E.R.I.C. No. JC670-407.

[19] George R. Morgenfeld. "The Prediction of Junior College Achievement from Adjusted Secondary School Grade Averages." Arizona University, Tucson, E.R.I.C. No. JC670-890.

THE RELATIONSHIP BETWEEN THE PREDICTOR AND CRITERION VARIABLES

Chapter III

INTRODUCTION

The first phase of the study involved a determination of the relationship between the predictor and criterion variables. This phase was itself divided into three parts. The first part established the relationship between the predictor variables to gain a greater understanding of the composition of the test battery.

The second part of this phase was to prepare a criterion-predictor correlation matrix, i.e., validity matrix, to note the correlation between each criterion course area and each predictor variable. The purpose of constructing this table was to see if the variables traditionally and intuitively associated with predicting success in any one of the areas did in fact display a high degree of correlation. This third part of phase one involved the construction of a criterion intercorrelation matrix. Although not considered a vital part of the original design of the study, the data was examined to discover if there was a high degree of relationship between courses at Yakima Valley College even though a significant relationship would not necessarily imply causation. Two courses could correlate perfectly yet not even duplicate each other, e.g., Intermediate Algebra grades might correlate highly with grades in College Algebra but the latter would be at a much higher difficulty level.

The Predictor Variables[1]

The test battery itself is currently composed of nine subtests which require approximately 5½ to 6 hours to administer. This battery was prepared to W.P.C.T.P. specifications by the Educational Testing Service and is not available commercially.

The nine subtests of the W.P.C.T. battery are: (1) Vocabulary, a test of antonyms; (2) English Usage, the use of grammar, punctuation, word choice, and capitalization; (3) Spelling, the selection of one mispelled word from a group of five words; (4) Reading, a test of both speed and comprehension, (scores are reported for both on the data report); (5) Quantitative Skills; (6) Applied Mathematics, the application of arithmetic and elementary algebra to simple practical problems; (7) Mathematics Achievement, an hour test of general mathematics, algebra and geometry; (8) Spatial Ability; and (9) Mechanical Reasoning. The test on quantitative skills includes three types of items: items of data sufficiency, items requiring the examinee to determine the relative size of two given quantities, and items in which the examinee determines the relationship among two, three, or four variables when given four sets of data for the variables. In addition to the above subtests which produce ten scores on the data report there are also three composite scores: (1) English Composite, a weighted average of the English usage, spelling and vocabulary subtests; (2) Verbal Composite, A weighted average of the Vocabulary,

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[1] Dr. William Kline. "The Washington Pre-College Testing Program." Paper presented at National Council on Measurement in Education Conference, Chicago, February 1965.

English Usage, Spelling, and Reading Comprehension subtests; and (3) Quantitative Composite, a weighted average of each part of the quantitative skills subtest, applied mathematics, and mathematics achievement. All scores, including the three composite scores, are in standard score form with mean of 50 and a standard deviation of 10. The program has selected the subtests cited above by a method of predictor selection. A large number of variables are initially included but only those that possess high correlation with the criterion and low relationship with the other predictors are retained for prediction. In this way the test battery has been developed which contains and maintains predictors measuring as many different elements relating to college success as possible yet is reasonable in terms of administration time, economy of cost, and flexibility for multiple uses. The W.P.C.T.P. is continuing to gather data and experiment with other variables to determine their contribution to the battery. If the new variables add significantly to the test's predictability they will be considered for inclusion. Thus the W.P.C.T.P. is constantly looking for ways to improve the instrument they have.

The student's performance on the test is statistically combined with his high school cumulative performance in six areas and overall performance as of the end of his junior year. The six major high school areas include: (1) English, (2) Foreign Language, (3) Mathematics, (4) Natural Sciences, (5) Social Sciences, and (6) Electives. The average grade of six semesters' work in each area is expressed as a grade point average. In addition to the high school averages and test scores the student's age and sex are also included as predictor variables. This study also asked that the calculations include the all-university prediction as a predictor variable although it was recognized that the score was statistically derived from the other predictor variables. For a more complete description of each predictor variable the reader is referred to the W.P.C.T. Counselors Manual[2] which is published annually by the program for use by the high school counselors and college student advisors.

The Predictor Intercorrelation Matrix

Before considering Table I the reader's attention is directed to Table IV which presents the mean, standard deviation, and number for each predictor variable.

Table I shows the relationship between the predictor variables. As indicated earlier this will show the correlation among the predictor variables and give the reader an overall idea of the make-up of the entire battery.

A logical question which is raised when evaluating Table I is: "What is considered a high or low correlation coefficient?" An answer to this question would have to be that each coefficient is

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[2] Washington Pre-College Testing Program. Counselor's Manual, 1967-68.

PREDICTOR INTERCORRELATION MATRIX

Table I

M.P.C.T. Predictor Variables

Pred.	Engl. Usage (1)	Spell. (2)	Read. Comp. (3)	Mech. Reas. (4)	Spatial Abl. (5)	Appl. Math (6)	Read. Speed (7)	Vocab. (8)	Quant. Skills(A) (9)	Quant. Skills(B) (10)	Quant. Skills(C) (11)	Math Ach. (12)
1	1.000	.626	.596	.115	.283	.447	.125	.691	.426	.453	.343	.428
2	.626	1.000	.439	-.035	.071	.303	.184	.550	.228	.283	.200	.241
3	.596	.439	1.000	.201	.271	.429	.334	.704	.409	.392	.296	.392
4	.115	-.035	.201	1.000	.450	.382	.029	.190	.344	.439	.243	.458
5	.285	.071	.271	.450	1.000	.454	-.039	.261	.432	.452	.301	.494
6	.447	.305	.429	.382	.454	1.000	.172	.370	.584	.698	.509	.726
7	.125	.184	.334	.029	-.039	.172	1.000	.217	.055	.086	.154	.090
8	.691	.550	.704	.190	.261	.370	.217	1.000	.399	.384	.238	.338
9	.426	.228	.409	.344	.432	.584	.055	.399	1.000	.593	.416	.583
10	.453	.283	.392	.439	.452	.698	.086	.384	.593	1.000	.484	.722
11	.343	.200	.296	.243	.301	.509	.154	.238	.416	.484	1.000	.541
12	.428	.241	.392	.458	.494	.726	.090	.338	.583	.722	.541	1.000
13	.142	.124	.102	-.041	.112	.067	.012	.143	.144	.123	.089	.115
14	.609	.503	.401	-.091	.127	.346	.055	.463	.293	.331	.281	.346
15	.476	.428	.277	-.056	.075	.263	.021	.339	.225	.273	.207	.293
16	.432	.306	.291	.097	.265	.455	.036	.277	.354	.458	.350	.525
17	.455	.341	.361	.078	.219	.349	.072	.375	.313	.364	.305	.398
18	.511	.402	.422	-.035	.125	.354	.102	.432	.304	.347	.251	.356
19	.393	.267	.253	.043	.203	.298	.035	.231	.274	.320	.237	.304
20	.490	.292	.444	.412	.488	.798	.143	.394	.697	.833	.788	.824
21	.909	.806	.683	.112	.250	.439	.198	.869	.416	.438	.305	.394
22	.910	.781	.692	.123	.261	.442	.200	.885	.425	.445	.312	.400
23	.745	.568	.619	.058	.308	.522	.140	.672	.471	.514	.388	.523
24	.178	.167	.016	-.387	-.074	-.153	-.068	.086	-.059	-.151	-.079	-.185
25	-.062	-.031	-.027	.041	.001	-.031	-.045	-.011	-.040	-.009	-.055	-.031

PREDICTOR INTERCORRELATION MATRIX

Table I - Continued

Pred.	High School Composite Averages								W.P.C.T.P. Composite Scores				
	G.P.A. (13)	Engl. (14)	F. Lang. (15)	Math. (16)	Nat. Sci. (17)	Soc. Sci. (18)	Elect. (19)	Quart. (20)	Verbal (21)	Engl. (22)	All-U Pred. (23)	Sex (24)	Age (25)
1	.142	.609	.476	.432	.455	.511	.393	.490	.909	.910	.745	.178	-.062
2	.124	.503	.428	.306	.341	.402	.267	.292	.806	.781	.568	.167	-.031
3	.102	.401	.277	.291	.361	.422	.253	.444	.683	.692	.619	.016	-.027
4	-.041	-.091	-.056	.097	.078	-.035	.043	.412	.112	.123	.058	-.387	.041
5	.112	.127	.075	.265	.219	.125	.203	.488	.250	.261	.308	-.074	.001
6	.067	.346	.263	.455	.349	.354	.298	.798	.439	.442	.522	-.153	-.031
7	.012	.055	.021	.036	.072	.102	.035	.143	.198	.200	.140	-.068	-.045
8	.143	.463	.339	.277	.375	.432	.231	.394	.869	.885	.672	.086	-.011
9	.144	.293	.225	.354	.313	.304	.274	.697	.416	.425	.471	-.059	-.040
10	.123	.331	.273	.458	.364	.347	.320	.833	.438	.445	.514	-.151	-.009
11	.089	.281	.207	.350	.305	.351	.237	.788	.305	.312	.388	-.079	-.055
12	.115	.346	.293	.525	.398	.356	.304	.824	.394	.400	.523	-.185	-.031
13	1.000	.261	.233	.266	.195	.219	.184	.146	.163	.151	.268	.347	-.031
14	.261	1.000	.660	.613	.659	.777	.551	.379	.610	.605	.849	.244	-.109
15	.233	.660	1.000	.591	.555	.570	.423	.295	.479	.474	.703	.174	-.063
16	.266	.613	.591	1.000	.571	.570	.455	.501	.398	.394	.701	.090	-.047
17	.195	.659	.555	.571	1.000	.656	.492	.406	.459	.455	.778	.074	-.098
18	.219	.777	.570	.570	.656	1.000	.517	.378	.524	.522	.814	.134	-.102
19	.184	.551	.423	.455	.492	.517	1.000	.345	.351	.348	.660	.099	-.088
20	.146	.379	.295	.501	.406	.378	.345	1.000	.461	.470	.566	-.114	-.044
21	.163	.610	.479	.398	.459	.524	.351	.461	1.000	.991	.775	.172	-.046
22	.151	.605	.474	.394	.455	.522	.348	.470	.991	1.000	.774	.156	-.043
23	.268	.849	.703	.701	.778	.814	.660	.566	.775	.774	1.000	.215	.000
24	.347	.244	.174	.090	.074	.134	.099	-.114	.172	.156	.215	1.000	.071
25	-.031	-.109	-.063	-.047	-.098	-.102	-.088	-.044	-.046	-.043	.000	.071	1.000

relative to the variable under consideration. For example, the correlation of .726 between (Applied Mathematics) and (Mathematics Achievement) is quite high but it is not possible to conclude a cause-effect relationship between the two subtests. The same interpretation of implied causation holds for the correlation coefficient between English Usage and Spelling.

The reader will note an extremely high correlation coefficient between English Usage and Verbal Composite (.909) and likewise between the former and English Composite (.910). This is to be expected however, since English Usage is part of the subtests which comprise both composite scores. Attention is also drawn to the coefficients relating Reading Speed and all other predictor variables. With the exception of Reading Comprehension, which shows an expected degree of relationship, the coefficients do not deviate greatly from "no" relationship. This would suggest that Reading Speed makes a unique but almost negligible contribution to the test battery.

The overall impression gained from surveying Table I is that the subtests having a predominantly verbal orientation intercorrelate to a moderate degree. Apparently the verbal ability one has or the verbal aptitude skills he is able to acquire underlie successful performance on each of the verbal subtests and are also reflected in high school verbal area success. For example, note the correlation coefficients between English Usage and the following: Spelling, Reading Comprehension, Vocabulary, High School English, High School Social Science, Verbal Composite and English Composite.

While identifying underlying skills it is interesting to note the correlations between the All-University Prediction and the predictor variables. If a comparison is made by considering the predominately verbal test scores which consist of English Usage, Spelling, Reading Comprehension, Vocabulary, Verbal Composite, and English Composite; a quantitative group composed of Applied Mathematics, Mathematics Achievement, and Quantitative Composite; and a group made up of the cumulative high school averages with the All-University Prediction, the differences are illuminating. First, the group of high school averages correlate highest with a prediction of success in college. The verbal subtests have a moderate correlation with the composite prediction and the quantitative group showed the least relationship. This suggests the well-documented conclusion that high school grades and the verbal skills seem to have a more significant relationship to college success than do the quantitative skills. This differential weighting is one reason why the W.P.C.T.P. chose to utilize high school grades in combination with verbal and quantitative subtests to generate variable 23 on the student's data sheet.

Sex and age show some degree of relationship with each of the predictor variables and thus add to the predictive validity of the test battery. Even though sex is a contributing factor, a study by Langen[3] concluded that generating separate regression equations for males and females did not appreciably enhance the predictability of the test.

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[3] Dr. Thomas Langen. "An Investigation of Additional Predictor and Criterion Variables for the Washington Pre-College Testing Program with Subdivision by Sex and Extent of Achievement." Study Supported by Washington Pre-College Testing Program, May 1965.

To summarize, it appears that each predictor variable now included in the current test battery is serving a useful function in increasing the predictive ability of the instrument.

The Criterion Course Variables

Before considering Table II it is necessary to define the criterion courses which were included in the study. The description of each criterion has been taken from the Yakima Valley College Catalog, 1967-68[4] and is as follows:

> Art Appreciation - Designed to lead to an understanding and appreciation of art with special emphasis on the contemporary period of painting, sculpture, architecture, and the decorative arts. For non-majors.
>
> General Biology - Investigations into the nature of life and those phenomena common to all living things.
>
> Introduction to Business - Survey of business objectives, policies, organizations and procedures.
>
> Inorganic Chemistry - The principles of chemistry for those who plan to take a year or more of chemistry courses, Prerequisites: satisfactory grade in high school chemistry or in Chemistry 103; Math 101 or qualified to enter Math 104 by adequate placement score or permission of instructor.
>
> Economic Geography - Location and characteristics of the raw materials, resources and resulting exchange of international economic cooperation and conflict.
>
> Introduction to Education - Includes units on teaching as a profession, history and philosophy of education, observation of classroom procedures and Washington's educational system. Recommended not to be taken until third quarter standing.

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[4] Yakima Valley College Catalog, 1967-68.

English Composition - Required of all freshmen who qualify on the basis of college entrance examination scores or adequate achievement in English 10, 50, or 51. Student writing progresses from simple exposition, using various rhetorical methods, to longer compositions requiring critical thinking and research.

Emphasizes the command of basic rhetorical principles in expository writing; use of particular details, examples, comparisons and contrasts, and development of thesis or support of central idea. Study of short stories, novels, plays, and poetry for ideas and for the observation of artistic technique.

Personal Health for Men - The approaches to healthful living. The laws of hygiene as they apply to the individual. Health information affords guidance in the formation of health habits and attitudes.

Personal Health for Women - Personal health and hygiene with emphasis on the physiology of the human system including the digestive system and the problem of nutrition; the reproductive system and social and hygienic aspects of sex.

History of Washington and the Pacific Northwest - A history of the Pacific Northwest with emphasis on the history of the state of Washington. This course provides a background for those who plan to teach state history and government and meets the requirements of state certification.

Intermediate Algebra - Review of elementary algebra, linear simultaneous equations, rational exponents, radicals, graphs, binominal theorem, logarithms. Prerequisite: one year high school algebra or Math 101. No credit received by students having completed third semester high school algebra.

College Algebra - Definitions, axioms, and laws of algebra, the complex number system, functions and graphs, polynominals and theory of equations, determinants. Prerequisite: Math 101 or advanced high school algebra.

Introduction to Philosophy - An introduction to problems of human thought which have continuing significance.

General Psychology - An introduction to the science of behavior.

Principles of Sociology - Basic principles of social relationships.

> Introduction to Public Speaking - Audience analysis, choice and organization of material, delivery. Frequent speeches are given before the class for criticism. Speech majors or students transferring to Washington State University or University of Washington are advised to take Speech 100 instead of Speech 140.

These criterion courses are normally taken by most students sometime in their two-year course of study and thus are fairly representative of the academic areas offered at Yakima Valley College. The courses are one quarter in length and the final grade is either A, B, C, D, F. WF, or AWF. Most of the criterion courses require only a minimal amount of high school course work in their specific areas. Only English and Mathematics require a minimum W.P.C.T. standard score for placement. For English the current critical cutting score is a 45 or above on the English Composite score for admission to college English and 44 or below for a non-transfer English sequence course. The mathematics courses currently require a standard score of 53 and above on the mathematics achievement subtest for entrance into college algebra while a score of 52 and below requires the student to enter intermediate algebra. An exception is made for those students who have completed two years of high school algebra.

The Criterion-Predictor Correlation Matrix

Part two of the first phase was considered a very important facet of the entire study. One of the stated purposes of this project was the determination of the test battery's ability to differentially predict student behavior at Yakima Valley College. The construction of a criterion-predictor correlation matrix to establish the relationship between each predictor variable with each criterion was a preliminary step leading to the development of regression equations to predict performance in each criterion course area.

Before proceeding with an analysis of Table II the reader is referred to Table V to note the mean, standard deviation and number of scores involved in each criterion course area. Returning to peruse Table II one needs to be cognizant of the number of scores in each criterion area since any significance is contingent on the sample size. Because the sample size is fairly small, one should be somewhat cautious about broad generalizations for Introduction to Business, Inorganic Chemistry, Introduction to Education, and Introduction to Philosophy.

The same caution should be applied to the interpretation of the mean and standard deviation values for each criterion area. Also the fact that the grades were reported in whole numbers (4, 3, 2, 1, 0) for a single course introduces error since it would be impossible for any person to obtain a mean grade for any of the courses in the study except Intermediate Algebra. With these cautions in mind, however, it is interesting to note the difference between the mean values of the different criterion areas. There is a range of mean values from 1.89 for Inorganic Chemistry to 2.80 for Introduction to Education. Also, with the exception of Inorganic Chemistry, the mean values for all of the other criterion areas lie above 2.00. This may suggest some trend in grading practices in all of the courses at Yakima Valley College, but there is not enough data available to make any firm statements.

Y.V.C. CRITERION PREDICTOR MATRIX

Table II

Pred. / Crit.	Engl. Usage (1)	Spell. (2)	Read. Comp. (3)	Mech. Reas. (4)	Spatial Abl. (5)	Appl. Math (6)	Read. Speed (7)	Vocab. (8)	Quant. Skills(A) (9)	Quant. Skills(B) (10)	Quant. Skills(C) (11)	Math Ach. (12)
Art 101	.443	.307	.337	.097	.213	.226	-.043	.444	.318	.270	.372	.363
Biol. 101	.374	.283	.350	.104	.175	.271	-.005	.371	.212	.275	.237	.294
I Bus. 101	.176	.148	.166	-.013	-.094	-.063	-.010	.00	.154	.093	.064	.181
Acct. 151	.197	.083	.091	-.015	.107	.240	-.002	.117	.192	.202	.081	.175
Chem. 104	.331	.182	.243	.099	.056	.314	.192	.211	.198	.294	.165	.428
Econ. 107	.255	.140	.213	.077	.070	.116	-.094	.223	.085	.128	.063	.187
Educ. 101	.316	.269	.282	.130	.143	.220	-.189	.439	.276	.167	.175	.251
Engl. 101	.374	.368	.225	.001	.092	.152	.031	.334	.194	.167	.151	.205
Health 115	.387	.348	.325	.022	.188	.268	.053	.401	.309	.287	.196	.293
Hist. 215	.254	.155	.289	-.063	.125	.198	.008	.318	.149	.164	.042	.172
C. Alg. 104	.329	.197	.107	.099	.156	.302	.046	.156	.285	.307	.147	.464
I Alg. 101	.422	.260	.178	.056	.189	.307	-.005	.191	.215	.329	.185	.365
Phil. 101	.188	.320	.269	-.045	-.043	.159	-.039	.228	.111	.209	.038	.220
Psych. 101	.460	.288	.371	.103	.263	.308	.020	.449	.339	.326	.213	.313
Soc. 101	.421	.266	.386	.076	.210	.247	.032	.427	.173	.238	.221	.294
P. Spk. 140	.261	.200	.182	-.019	.138	.170	.000	.187	.174	.223	.154	.125

Y.V.C. CRITERION PREDICTOR MATRIX

Table II - Continued

		G.P.A.'s						Composits						
P / C	H.S. G.P.A. (13)	Engl. (14)	F. Lang. (15)	Math. (16)	Nat. Sci. (17)	Soc Sci. (18)	Elect. (19)	Quart. (20)	Verbal (21)	Engl. (22)	All-U Pred. (23)	Sex (24)	Age (25)	N
Art 101	.096	.532	.346	.384	.543	.536	.298	.324	.462	.472	.582	.066	-.011	187
Biol. 101	.198	.543	.378	.427	.483	.580	.344	.292	.399	.395	.574	.017	-.083	363
I Bus. 101	.096	.249	.181	.188	.102	.281	.000	.097	.164	.175	.218	.165	-.070	107
Acct. 151	-.081	.272	.220	.299	.261	.250	.264	.174	.169	.164	.349	.063	.144	168
Chem. 104	.365	.456	.442	.526	.547	.411	.320	.338	.288	.287	.518	.022	.129	121
Econ. 107	.031	.348	.268	.257	.145	.317	.299	.121	.248	.257	.375	.030	-.009	238
Educ. 101	.028	.408	.210	.310	.406	.455	.310	.242	.402	.399	.494	.177	.080	143
Engl. 101	.267	.458	.346	.300	.335	.395	.394	.209	.385	.389	.461	.135	.030	970
Health 115	.295	.469	.357	.329	.414	.447	.298	.307	.443	.448	.533	.161	.010	804
Hist. 215	-.025	.464	.285	.307	.388	.447	.314	.129	.286	.300	.487	.010	-.050	244
C. Alg. 104	.259	.455	.315	.455	.400	.429	.339	.356	.278	.272	.483	.172	.019	273
I Alg. 101	.071	.424	.394	.453	.371	.376	.295	.355	.358	.355	.485	.223	-.071	286
Phil. 101	.079	.237	.329	.280	.228	.326	.139	.121	.282	.253	.342	.015	.187	132
Psych. 101	.233	.467	.371	.362	.450	.484	.342	.352	.462	.476	.557	.066	-.007	690
Soc. 101	.044	.471	.376	.352	.444	.457	.369	.284	.446	.446	.568	.041	.012	460
P. Spk. 140	.060	.436	.265	.253	.378	.389	.336	.179	.247	.260	.429	.064	.024	404

The standard deviation values for each criterion area are also quite interesting. With the exceptions of Introduction to Business, Economic Geography, and College English, all standard deviation values exceed 1.00. Although these deviation values probably are not larger than those derived from the total W.P.C. sample they do indicate a wide diversity of academic abilities and a real problem exists to develop each individual to his fullest potential.

To gain the most benefit from Table II one should examine each correlation coefficient individually to see what relationship exists between each predictor variable and each criterion variable.

It might be well to consider dividing this table into the three major groups as was done in Table I. It will then be possible to determine if the same differential weighting of verbal areas predicts academic success as well for specific two-year introductory courses as it does for establishing the All-College prediction based on university students.

Upon examination of the seven high school cumulative averages the first observation which draws attention is that the high school cumulative G.P.A. shows only slight relationship with any of the criterion courses. Apparently the high school composite has less relevance for predicting academic behavior than the specific elements which comprise it. A cursory examination reveals that high school English and high school Social Science have the highest coefficients with most of the criterion courses. Of course there are exceptions such as a coefficient of .526 between high school

Mathematics and Inorganic Chemistry, which might be anticipated. However, when the regression equations are developed in the next chapter the specific variables which contribute most significantly in predicting each criterion grade will be identified.

The predictor variables cited earlier which are primarily verbal appear to correlate to a moderate degree with most of the criterion areas. Two exceptions to this are Introduction to Business and Principles of Accounting. It is interesting to note that these verbal subtests correlate more highly with Intermediate and College Algebra than they do with Introduction to Business and Principles of Accounting, although it is popularly assumed that the same skills are necessary for successful performance in all four course areas. The same effect will be illustrated in the regression equations for these criterion courses. Reading Speed, although considered as part of the verbal group appears to be a unique variable here as well as in Table I. In fact, this variable shows only a slight relationship with all of the criterion courses and the relationship is negative in 50% of thes cases. On the surface this would appear to be the variable which could most easily be eliminated without unduly influencing the differential predictability of the battery, but before this is done the possibility should be checked that Reading Speed may be a significant suppressor variable and should thus be retained.

The quantitative variables referred to earlier show a lesser degree of relationship with the criterion areas than does the verbal group. Even in those criterion areas like Inorganic Chemistry, Intermediate and College Algebra, where it might be anticipated that a moderately high correlation would exist such does not appear to be the case. In fact, English Usage appears to correlate with these criterion areas to an equal or greater degree than most of the quantitatively oriented subtests.

One observes also that Mechanical Reasoning and Spatial Ability seem to have very little relationship with any of the criterion courses. This would imply that these subtests are apparently measuring unique abilities that lie outside of the areas traditionally considered to measure potential for success in a college or university curriculum. However these variables may also be suppressor variables and, when considered within the context of the regression equation, be quite useful in prediction.

The All-College prediction appears to be the best single indicator of success in each of the criterion courses. Since it is a weighted composite of the high school cumulative averages of the subtest scores this would be expected. But the size of the individual correlation coefficients definitely supports the conclusion that the W.P.C.T. is measuring those abilities and achievement levels which are necessary to predict successful behavior in the college transfer courses offered by Yakima Valley College.

The predictor variables Sex and Age also seem to fit into the same category as Reading Speed. The relationship of each of these variables with each of the criteria is slight to negligible and, in some cases, a negative relationship exists. It is understood, however, that their inclusion and interaction with other predictor variables enhances the battery predictability but, when considered separately, their contribution is small.

A comparison of the validity coefficents in Table XXIX for the criterion areas predicted by the W.P.C.T.P. and comparable all-college criterion areas included in Table II of this study leads to the inference that the test battery is predicting as well if not slightly better at Y.V.C. than at the University of Washington. Those criterion areas where an approximate comparison could be made included General Biology, Inorganic Chemistry, Economic Geography, College English, College Algebra, Introduction to Psychology, and Introduction to Sociology.

Also, it appears that the predictor variables have approximately the same differential weight in predicting student academic performance at Yakima Valley College as at the University of Washington. The specific high school cumulative averages appear to be the best predictors, followed by those subtests which attempt to measure verbal skills and finally those subtests which assess quantitative skills levels.

The all-college prediction, which is a composite score that gives more differential weight to verbal skills, but includes all predictor variables, appears to have the highest overall relationship with all of the criterion courses.

The Criterion Intercorrelation Matrix

The data for a criterion intercorrelation matrix was also produced as a by-product of obtaining the data for Tables I and II.

In most cases, however, the number of subjects involved in the computation of the correlation coefficients was so small that the derived index number was insignificant. However, some of the criterion correlations contained enough cases so that some interpretation could be made. Therefore, the discussion for Table III will be confined to only those correlation coefficients with a number of cases exceeding 100.

A correlation of .500 was obtained between General Biology and College English. In addition, Biology correlated well with Health and Psychology as might be expected.

College English has a fairly good relationship with College Algebra, Psychology and Public Speaking. There was also a moderate relation between College English and Health and History of the Pacific Northwest.

Health Education has a moderate relationship with History, Psychology, Sociology and Public Speaking.

Psychology has a moderate correlation with Sociology and a slight relationship with Public Speaking.

The rest of the correlation coefficients have not been interpreted because of the small sample which resulted in dubious significance.

CRITERION INTERCORRELATION MATRIX

Table III

P / C	Art 101 (26)	Biol. 101 (27)	I Bus 101 (28)	Acct. 151 (29)	Chem. 104 (30)	Econ. 107 (31)	Educ. 101 (32)	Engl. 101 (33)	Health 115 (34)
Art 101	1.000	.427	ND*	.276	.827	.344	.482	.470	.523
Biol. 101	.427	1.000	.000	-.127	.575	.320	.378	.500	.496
I Bus. 101	ND*	.000	1.000	-.151	-.419	.414	.090	.257	-.099
Acct. 151	.276	-.127	-.151	1.000	.000	.047	.386	.222	.242
Chem. 104	.827	.575	-.419	.000	1.000	.577	.561	.539	.503
Econ. 107	.344	.320	.414	.047	.577	1.000	.378	.213	.246
Educ. 101	.482	.378	.090	.386	.561	.378	1.000	.299	.469
Engl. 101	.470	.500	.257	.222	.539	.213	.299	1.000	.391
Health 115	.523	.496	-.099	.242	.503	.246	.469	.391	1.000
Hist. 215	.408	.430	.258	-.050	.550	.196	.548	.366	.427
C. Alg. 104	.378	.362	.515	.275	.682	.307	.486	.401	.389
I Alg. 101	.482	.358	.096	.519	.296	.209	-.138	.332	.346
Phil. 101	.120	.340	.000	.435	-.749	.132	.380	.340	.161
Psych. 101	.465	.589	.182	.287	.172	.298	.472	.427	.504
Soc. 101	.360	.386	-.116	.010	.368	.161	.440	.372	.475
P. Spk. 140	.583	.326	.384	.529	.468	.251	.209	.467	.451

* Not - Only one case so not possible to derive meaningful correlation coefficient

CRITERION INTERCORRELATION MATRIX

Table III - Continued

P C	Hist. 215 (35)	C. Alg. 104 (36)	I Alg. 101 (37)	Phil. 101 (38)	Psych. 101 (39)	Soc. 101 (40)	P. Spk. 140 (41)	N
Art 101	.408	.378	.482	.120	.465	.366	.583	187
Biol. 101	.430	.362	.358	.340	.589	.386	.326	363
I Bus. 101	.258	.515	.096	.000	.182	-.116	.384	107
Acct. 151	-.050	.275	.519	.435	.287	.010	.523	168
Chem. 104	.550	.682	.296	-.749	.172	.368	.468	121
Econ. 107	.196	.307	.209	.122	.298	.161	.251	238
Educ. 101	.548	.486	-.128	.380	.472	.440	.209	143
Engl. 101	.366	.491	.232	.346	.427	.372	.467	970
Health 115	.437	.389	.346	.161	.504	.475	.451	804
Hist. 215	1.000	.424	.254	.122	.345	.224	.505	244
C. Alg. 104	.424	1.000	.431	.061	.326	.452	.367	273
I Alg. 101	.254	.431	1.000	.429	.216	.301	.215	286
Phil. 101	.122	.061	-.429	1.000	.247	.198	.244	132
Psych. 101	.345	.326	.216	.247	1.000	.396	.253	690
Soc. 101	.224	.452	.301	.198	.396	1.000	.300	460
P. Spk. 140	.505	.367	.215	.344	.253	.300	1.000	404

MEAN, STANDARD DEVIATION AND NUMBER FOR EACH PREDICTOR VARIABLE

TABLE IV

Variable	Table Mean	S. D.	N
Engl. Usage	33.24	15.42	1678
Spelling	13.78	8.15	1667
Reading Comp.	8.96	5.67	1667
Mechanical Reas.	8.29	7.04	1656
Spatial Ability	9.44	4.56	1667
Appl. Math	9.28	4.83	1675
Reading Speed	25.26	5.63	1678
Vocabulary	41.95	17.31	1675
Quant. Skills (A)	5.80	3.13	1663
Quant. Skills (B)	11.62	5.71	1673
Quant. Skills (C)	4.15	3.57	1638
Math Achievement	10.97	8.62	1668
G.P.A.	19.53	10.73	1361
English	23.80	6.80	1624
Foreign Language	21.55	8.73	1419
Math	21.31	7.17	1623
Natural Science	22.50	7.17	1611
Social Science	24.15	7.21	1625
Elect.	27.47	6.55	1597
Quart.	47.34	7.90	1678
Verbal	46.39	9.20	1678
English	46.35	9.26	1678
All-U. Pred.	18.46	4.54	1625
Sex	.26	.44	1678
Age	17.42	2.63	1678

NUMBER, MEAN, STANDARD ERROR OF THE MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF ESTIMATE FOR EACH CRITERION VARIABLE

Table V

Course Area	N	Mean	S.E. mean	S.D.	S.E. est.
Art 101	187	2.42	.086	1.07	.781
Biol. 101	363	2.12	.064	1.21	.933
I Bus. 101	107	2.49	.077	.79	.672
Acct. 151	168	2.08	.084	1.08	1.005
Chem. 104	121	1.89	.110	1.21	.856
on. 107	238	2.35	.060	.93	.825
Educ. 101	143	2.80	.095	1.13	.845
Engl. 101	970	2.09	.031	.98	.851
Health 115	804	2.57	.038	1.06	.880
Hist. 215	244	2.50	.077	1.20	.996
C. Alg. 104	273	2.28	.007	1.27	.961
I Alg. 101	286	2.00	.072	1.22	1.006
Phil. 101	132	2.46	.094	1.08	.894
Psych. 101	690	2.14	.042	1.10	.889
Soc. 101	460	2.55	.051	1.10	.891
P. Speaking 140	404	2.60	.055	1.03	.894

SUMMARY

The predictor intercorrelation table and the criterion-predictor correlation table both indicated that a differential weighting favoring high school cumulative averages and verbal factors could be used to predict academic behavior with a reasonable degree of accuracy. The specific high school cumulative grade areas appears to be the best predictor variables while those subtests assessing quantitative skills showed the least relationship to academic success. Mechanical Reasoning, Spatial Ability, Reading Speed, Age and Sex seemed to be unique variables which contributed to the overall predictability of the test, but showed only a minimal relationship with the criteria when considered individually. More needs to be known about these variables before statements can be made for their inclusion or exclusion from the test battery.

The data from the criterion-predictor matrix lead to the impression that the current W.P.C.T. is doing reasonably well in predicting student performance at Yakima Valley College. The regression equations, percentage of variance contributed by each variable and coefficient of multiple correlation for each criterion will either substantiate or cast doubt on the accuracy of this observation. This is the second phase of the study which will be presented in the next chapter.

MULTIPLE REGRESSION ANALYSIS

Chapter IV

INTRODUCTION

Chapter III summarized that the predictor variables which comprise the W.P.C.T. do a reasonably good job in predicting student academic behavior at Y.V.C. This conclusion led to phase two of the project which was the establishment of regression equations to more accurately determine the relative contribution of each predictor variable in estimating the grade to be achieved in each Y.V.C. criterion area.

The regression equations were generated for each criterion area and they can be found in Appendix A. Incidently, all of the composite scores, English Composite, Verbal Composite, Quantitative Composite, and High School Cumulative Grade Point Average were excluded as predictor variables because they were derived from a weighted combinationof other predictor variables.

The tables in Appendix A indicate the regression equations (Beta and b weights), percentage of variance, and multiple correlation (corrected, uncorrected) for each criterion course area. The first statistic to note on each table is the corrected coefficient of multiple correlation (Rc). This coefficient indicates the strength of relationship between the criterion and all of the predictors taken together. Rc is related to the intercorrelations of the predictor variables (see Table I) as well as to their correlations with the criterion (see Table II). However, once computed, Rc is subject to the same kinds of interpretation, as to size and importance, as a simple correlation coefficient"r". Thus a coefficient of multiple correlation which falls between .50 to .70 would appear to indicate a moderate to strong relationship between the predictors and the criterion.

The corrected coefficient of multiple determination (Rc^2) is a related statistic which has relevance for the data in question. This indicates the proportion of variance in the criterion that is dependent upon, associated with, or predicted by all of the predictor variables with their proper weighting. To use Art Appreciation as an example, Rc= .67 and Rc^2= .449, it can be said that if knowledge of high school performance and all of the W.P.C.T. test results were available, it would be possible to account for approximately 45 per cent of the variance which influences the grade a student will earn in Art Appreciation. The remaining percentage of variance, $1-R^2$, or approximately 55 per cent, is still to be accounted for and is usually expressed as K^2, the coefficient of multiple nondetermination. Such things as different instructors, grading practices, student motivation, attendance, etc., are variables which are not accounted for by the test but nevertheless influence the grade which is earned.

In addition to having knowledge of amount of variance predictable by knowing all of the predictor variables we also wish to know how much each individual variable contributes to predict the grade. Each predictor variable will contribute something to predict the grade in each criterion course but in many cases the contribution will be so small that it is almost negligible. For that reason the computer was instructed to disregard all predictor variables which contribute below a specified minimum level for each criterion area. Thus what is included in the column entitled Percentage of Variance are those variables making a significant contribution in each case. The number value following each predictor variable for each criterion course provides the proportion of variance accounted for by that particular variable for that given set of predictors. To refer to the example of Art 101 cited earlier, 45 per cent of the variance could be accounted for by knowledge of the predictor variable values. To break this percentage figure down to the contribution of each individual variable it can be said that Vocabulary can account for 11.43 per cent of the 45 per cent accountable variance and high school Natural Science accounts for 11.28 per cent of the accountable variance. The two variables together can account for 22.5/45 or 50% of the accountable variance. Such information may have relevance in the determination of critical cutting scores for sectioning and placement.

It can be observed that Applied Mathematics has a negative value of -3.77 which means that it is a suppressor variable. When considered individually this variable seems to hinder prediction of the grade in Art Appreciation but, when considered as part of the battery, it adds to the validity of the prediction by subtracting invalid variance from the valid predictors.

Finally it is necessary to present some information about the regression equations for each criterion course. The equations have been written in both raw score (b) and standard score (Beta) form for each criterion variable. For purposes of this discussion, reference will only be made to the Beta weight values.

The main reason for developing a regression equation is to predict the most likely criterion value from known measurements in the predictor values. If the multiple coefficient of correlation value was 1.00 we could predict the criterion grade with complete accuracy and the errors of prediction would be zero. If Rc= 0.00, predictions would be futile. Between these extremes predictions can be made with some degree of error and the higher the correlation the more accurate the prediction.

To interpret the Beta weight regression equation for Art 101 we may say that for every unit increase in Applied Mathematics, Art 101 decreases by .1663 unit; for a unit increase in Reading Speed, Art 101 decreases by .1554 unit; for a unit increase in Vocabulary, Art 101 increases by .2569 unit, etc. Thus if the standard score value for each of the indicated predictor variables were known we could predict the student's grade in Art Appreciation within the limits of the standard error of multiple estimate.

Determination of Degree of Significance Between Y.V.C. and W.P.C.T. Criteria

After the regression equation, Rc, Rc^2 and percentage of variance accounted for by each significant predictor variable for each criterion course has been surveyed, a logical question could be asked about the extent to which these statistics compare with equivalent statistics obtained by the W.P.C.T.P. An answer to the question of the relevancy in utilizing prediction equations based on senior colleges for the same purpose at junior colleges is vital. Earlier studies concluded that these two types of institutions were serving different functions and meeting different educational needs, and evaluative comparisons were often inappropriate. Therefore, it is necessary to determine, if possible, whether Y.V.C. is justified in using the data provided by the W.P.C.T.P. or if local regression equations and percentile tables need to be created.

The fact that the criterion groups for Y.V.C. and W.P.C.T.P. are based on different populations besides being defined in a different manner leads to the conclusion that the results of any type of test for significance should be suspect. With a full awareness of the existance of these conditions it was decided to determine if a significant difference existed between seven criterion courses at Y.V.C. and equivalent W.P.C.T. prediction areas considered to be roughly comparable.

Since two independent samples existed with no possibility of matching of samples it was decided to utilize the standard deviation values for each group and compute the F ratio. By testing the significance of differences between standard deviations it could be determined whether or not the two independent variances could probably have arisen by random sampling from the same population of observations, or from two populations with the same variance. Table VI presents the findings for the seven chosen areas of comparison.

Table VI
F Ratio Table for Significant
Difference Between Independent Variance*

Course	Y.V.C. $S_1 2$	W.P.C.T. $S_2 2$	$\frac{df_1}{df_2}$	F
Biol. 101	362	316	362	1.33 **
Chem. 104	121	2,096	$\frac{121}{2096}$	1.41 ***
Econ. 107	237	2,151	$\frac{237}{2150}$	1.09
Engl. 101	969	4,754	$\frac{969}{4754}$	1.62 ***
Math.104	272	2,546	$\frac{272}{2545}$	1.49 ***
Psych. 101	689	2,505	$\frac{689}{2505}$	1.31 ***
Soc. 101	459	2,596	$\frac{559}{2595}$	1.19 ***

* Only for those criterion areas where it is felt a comparison is legitimate between Y.V.C. and W.P.C.T.P.

** p. .05

*** p. .01

The results of this table could have been anticipated but are nonetheless interesting. The equation for an F ratio is $F=\frac{s1^2}{s2^2}$ and the ratio that satisfies the null hypothesis completely is equal to 1.00. As the ratio departs from 1.00 the differences are greater.

Because of these findings no further attempt will be made to make evaluative comparisons between the two groups. However, in Chapter V a descriptive comparison will be made between percentile tables to ascertain whether it might still be possible to utilize the W.P.C.T.P. published data or if it will be necessary to develop local criterion data on a continuing basis.

Even though a significant difference is assumed to exist between the two groups one still cannot help but think that such a difference results from a difference in degree rather than kind. It would seem logical that the same abilities such as verbal ability, reading a book, taking notes, questioning, etc., which are required for success at the senior institutions would also be necessary at the junior college. So while an apparent difference exists between the two populations it would seem reasonable to attribute it to selective admissions and a higher level of learning skill development and potential rather than ascribe it to different skills entirely.

Each community college could produce its own testing program and probably increase the predictive accuracy for their students but the cost and time would not warrant the small amount of gain over the W.P.C.T.P. current test battery. However, in view of the findings to this point, it is apparent that Yakima Valley College would profit most by continuing to supply data and support the existing program as long as it remains able to measure and predict at its current level of accuracy for the Y.V.C. student.

SUMMARY

The multiple regression equations in standard score and raw score form were generated for each Y.V.C. criterion area. In addition the coefficient of multiple correlation, coefficient of multiple determination and percentage of variance accounted for by each significant contributing variable were computed. The size of Rc for most of the criterion courses gave considerable support to the belief that the test is applicable at Y.V.C.

With an awareness of the limitations imposed on any statistical test of significance between Y.V.C. and W.P.C.T.P. data because of differing criteria and a more select population, an attempt was made to determine if a real difference was present. Seven criterion courses at Y.V.C. were selected to be tested against W.P.C.T. prediction areas considered to be somewhat comparable. With the exception of Economic Geography it was determined that a real difference in the samples existed at the .05 level of significance or better. Thus there would be no purpose in making any evaluative comparisons but descriptive differences could be noted.

The data would seem to indicate that it would be possible to increase the accuracy of measuring academic success by developing a Y.V.C. battery. However, such a project, although it could possibly increase the predictive accuracy to a modicum degree, would probably not be worth the time, expense, and effort. By continuing to supply data which can be used to revalidate and update the test as well as establish relevant norm group data, Y.V.C. can profit from using the existing W.P.C.T.P. battery.

DEVELOPMENT OF PERCENTILE TABLES BASED ON YAKIMA VALLEY COLLEGE NORM GROUP

Chapter V

INTRODUCTION

The third phase of this study involved the development of percentile tables for Yakima Valley College students. It was recognized that the total number of 3000 criterion data cards contained much overlap as most students took more than one criterion course during the year. However, it was decided to continue even with this limitation and regardless of whether a statistically significant difference was obtained between the W.P.C.T. and Y.V.C. data. In the event a statistically real difference between the two was discovered, it would be necessary to generate new percentile tables based on the Y.V.C. student population. But if no significant difference was found it would still be valuable knowledge to compare our percentile tables with those produced by the W.P.C.T.P. for both four-year and community colleges.

The associated statistical data leading to the development of Y.V.C. percentile tables and the tables themselves in standard score form (mean = 50, standard deviation = 10) for male, female, and total group may be found in Appendix B of this report. These include mean, median, mode, range, semi-interquartile range, standard error of skewness, and variance. The percentile tables published by the W.P.C.T.P. in their 1967-68 Student Instruction Booklet have also been reproduced with permission and included for descriptive comparison purposes.

Comparison of Y.V.C. Percentile Tables for Male, Female, and Total Group

None of the observations of discrepancies between percentile levels for each sex N or the Y.V.C. versus W.P.C.T. percentile values has been statistically tested to determine if a significant difference exists. The difficulty in equating criterion areas for comparison purposes and sample size were factors in this decision. Therefore, we only will present observations and trends between Y.V.C. and W.P.C.T. community college and all-college percentile tables. This is done with the awareness that differences between the Y.V.C. and community college percentile tables may be but probably are not statistically significant. However, the obtained differences between the Y.V.C. percentile table and the all-college table would probably be real since the latter table is based primarily on four-year college and university students.

A comparison was first made between males and females at the 50th percentile for Yakima Valley College students. The females show better high school cumulative averages in all six designated areas. When comparing test score values corresponding to the 50th percentile for both groups it is observed that the females score higher in all of the verbal measures except Reading Speed. However, the males have higher standard scores for the quantitative measures such as mathematics, quantitative skills, spatial ability and mechanical reasoning. It is interesting that males have higher test scores in mathematics but a lower high school cumulative average in mathematics than females. It is hypothesized that the test scores reflect differences in ability while the discrepancy in high school mathematics represents differences in grading practices.

The same types of discrepancy between males and females are noted at both the 25th and 75th percentile levels. The greatest degree of difference between the sexes occurs in English with foreign languages and natural sciences also showing a divergence. The high school electives have the closest degree of correspondence between the sexes at all percentile levels.

When comparing the percentile table for the total group with each sex one is immediately attracted to the observation that the total compares much more closely with the male percentile table than the table for females. It could be speculated that the higher high school averages attained by females permits them to meet the more stringent entrance requirements of the four-year colleges and universities of the state and they thus matriculate at that level. The males, on the other hand, must begin their higher education at the community colleges which do not have such rigid admissions qualifications by state law. Therefore, the majority of freshmen men who desire to begin their collegiate careers must do so at the two-year level and this differential male/female ratio is reflected in the total group table at Y.V.C. More will be said on this when comparing the community college and all-college norm published by the W.P.C.T.P.

Comparison of Y.V.C. and W.P.C.T.
Percentile Tables

The following comparisons will be made between the total group table for Y.V.C. and those tables produced by the W.P.C.T.P. in their 1967-68 Student Instruction Booklet. The inclusion of a percentile table for community college students is based on data supplied by six community colleges including Y.V.C. for a study of this problem by Drs. Clifford and Patricia Lunneborg[1].

An evaluation of the percentile table for Y.V.C. with the one generated for community college students shows the two to be almost identical. The largest discrepancy in the high school cumulative averages at the 50th percentile is only .2 for English and the largest difference between test scores is only 2 standard score points on English usage, Reading Speed, Quantitative skills, and Mechanical reasoning. With the exception of a 4 standard score point differential on Mechanical reasoning the two tables are within the same discrepancy as the 50th percentile for high school cumulative averages and within 3 standard score points for both the 25th and 75th percentile levels. Based on observation it appears that our data and, indirectly, our student population, are almost identical to the students in other community colleges in Washington. There is some error in this last statement unless the assumption is valid that the six two-year colleges contributing data for the development of W.P.C.T. community college percentiles are representative of all the junior and community colleges of the state. In any event, Y.V.C. can have as much information to assist their students to understand their W.P.C.T. data report by using the table generated by W.P.C.T.P. as by developing their own norm group. It would be necessary however, to periodically validate the table to check for changes in student population characteristics and continue to supply data for inclusion in studies by W.P.C.T.P. as part of their constant policy to revise the norm groups.

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[1] Dr. Clifford Lunneborg and Dr. Patricia Lunneborg. "Community College Norms (1963-1965) for the Washington Pre-College (W.P.C.T.) Test Battery and High School Grades." Bureau of Testing Project No. 366-520, University of Washington, April 1967.

The reader is now invited to note comparable areas at the 25th, 50th, and 75th percentile levels between the Y.V.C. Total Group Table and the W.P.C.T.P. All-College Table. The W.P.C.T. All-College percentile table is predictably higher than the one for Y.V.C. The higher admissions requirements produce a more select population and this is reflected in the test scores. Also the norms for former group includes performance in a four-year curriculum in many cases versus a single course area for Y.V.C. The entering university freshman has been found to have higher potential and more sophisticated learning skills than the entering junior college freshman. In addition, the university student probably has greater motivation to learn and the emotional and social maturity to profit from his experiences. These factors seem to be lacking or at least not developed to the same degree in the junior college student. This is not meant to imply that all that is needed is training because learning ability may be much lower but, if the desire to learn and some specific learning skills can be developed, the student could transfer to a four-year college or university and be prepared, within limits, for the challenge.

This fact may be put to good use in counseling a prospective college student who may have some unrealistic levels of aspiration in relation to measured achievement and ability. By plotting the student's scores on both the four-year and community college percentile tables he can be graphically shown the percentile level he attains as compared to each population. This should have meaning for such a student.

Summary

There appears to be some difference between male and female performance as reflected in the percentile tables for Y.V.C. The females are consistently higher in all measured high school areas. The females also show higher verbal test scores than males but the reverse holds for quantitative measures. It is suggested that the test score differences are probably due to native ability and the high school averages reflect grading practices.

The total group table conforms more closely to the male norms than for the opposite sex. This could be the result of a greater male to female ratio at the two-year college which, in turn, could be the result of lower average high school performance and lack of development of basic learning skills. This factor would deny many male students of the opportunity to enter the four-year institutions directly upon leaving high school and force them to attend the community college. It is fully recognized that many other factors besides G.P.A. play a part in the student's decision to go to a junior college first with the idea of transfering but certainly past high school performance is a major reason.

The Y.V.C. total group percentile table is almost identical with the community college table published by the W.P.C.T.P. The differences between the two in most cases are so slight that they may reasonably be attributed to chance factors. Therefore, the community college table published by the program is probably just as applicable to Y.V.C. students as one which is produced by the college itself and there is no need to duplicate effort. This is true as long as the college periodically conducts a validity check and continues to be part of the sample group from which the percentiles are calculated.

There is, in all likelihood, a significant difference between corresponding scores for the W.P.C.T. All-College and Y.V.C. Total Group percentile tables. A consideration was given to some of the factors which may account for this real difference such as development of learning skills, social and emotional readiness to profit from the experience, etc. Finally it was suggested that pointing out the discrepancies between the two tables may help the student with unrealistic levels of aspiration.

CONCLUSIONS AND RECOMMENDATIONS

Chapter VI

CONCLUSIONS

This study was initiated out of an awareness that many questions were being asked about the junior college but few answers were forthcoming. It is not certain whether any more answers exist now, but this project has provided impetus for further exploration and analysis.

A second purpose of this study was to demonstrate the need for an organized and dynamic program of institutional research at Y.V.C. and the results, as summarized at the end of each chapter, show what can be provided if the opportunity and support to do research is available. It is hoped that, in addition to convincing both administration and faculty of the need for research, an eagerness to utilize the findings to implement new programs or revise old ones will result if the evidence warrants it. Research for research sake is not really appropriate for the junior college at its present stage of development. What is needed are the descriptive studies which define and delineate the parameters of community college education.

The literature review revealed a difference between the two-year and four-year college populations and the findings of this project tended to corroborate this. Just what these differences may be however, is very difficult to isolate and define. Whether completely different abilities underlie success at a senior institution versus a junior college or whether the difference is just differing amounts of the same learning skills and maturity levels is a question that has not been conclusively answered.

A relatd finding of this study was the apparently insignificant difference between the Y.V.C. sample and the data supplied by other community colleges to develop Washington community college norms. Although other states report a wide divergence in student performance between community colleges such does not appear to be the case between at least six Washington community colleges, (See chapter V). Just how relevant this conclusion is for the other two-year colleges in this state can only be determined by studies similar to this one at other institutions.

The overall findings strongly suggest that the W.P.C.T. test battery is doing a reasonably good job in predicting student academic behavior in the sixteen criterion course areas at Yakima Valley College. It is possible that a local test battery could be constructed which would enhance the predictive validity for Y.V.C. students, but is doubted that the increment would warrant the expenditure in cost, time or facilities. For the present the W.P.C.T.P. and their instrument seem to be the best available source for information about student academic potential at Y.V.C.

The regression equations and percentage of variance values for the significant predictors of each criterion area could be utilized on a pilot study basis to test their usefulness in selecting students with the greatest probability for success. The obtained equations could be set up to predict a student's performance in each of the areas and then test for any significant difference between the grade predicted by W.P.C.T.P. and the one predicted at Y.V.C. Also a similar study could be repeated by combining this project's data with data for student performance in the same criterion areas this year.

RECOMMENDATIONS

Predicated on the findings of this project and the conclusions which were derived, the following recommendations will be made for the perusal and consideration of Yakima Valley College faculty and administration:

1. The development of a pilot project to utilize the Y.V.C. regression equations to place a sample of students in the criterion classes and compare their performance with a control group of students who entered the same classes by free choice. If a significant difference is found to exist then some support would be found for more stringent placement of students into areas where their initial probability of success is greatest.

2. Yakima Valley College should continue to utilize the W.P.C.T.P. data report and place more emphasis on the admissions requirement that the data report be in the student's folder at the time of his matriculation. Since the test scores appear to be relevant to predict student performance, the data must be available before it can be useful.

3. The college extends its support of the W.P.C.T.P. by using the test and supplying data for research purposes when the need for it can be justified. Only by remaining a part of the norm group will Y.V.C. continue to receive useful information on its students.

4. Develop a more comprehensive and organized research program at Y.V.C. to provide empirical data upon which to base decisions that need to be made. This study marks the beginning of a dynamic program that will be fruitful if allowed the freedom to develop. Of course any research program is only as good as the people who contribute to it. It is hoped Y.V.C. will

recognize that research seeks information rather than threatens those who participate.

5. Continue to revalidate the percentile norms based on Y.V.C. data and compare them with those generated by the W.P.C.T.P. If the percentiles are an accurate presentation of the Y.V.C. student population, much relevant and valid data will be available. For example, the instructor could determine a particular percentile level as being minimal for success in one of the criterion courses. Since the most significant predictors are now known, the exact standard score value corresponding to the established percentile level could be ascertained. At least the placement would be based on empirical data rather than serendipity and it would be possible to revise the critical cutting scores if future findings warranted it.

6. Communicate with other community colleges to provide mutual assistance in research areas of common interest. Hopefully, the other community colleges can profit from the advances and errors made by this study and consider similar or related studies at their respective institutions.

APPENDIX A

TABLE VII
PREDICTOR AND CRITERION CODE NUMBERS FOR THE REGRESSION EQUATIONS AND PREDICTOR SELECTION

Predictors	Criterion
1. English Usage	26. Art Appreciation
2. Spelling	27. General Biology
3. Reading Comprehension	28. Intro. to Business
4. Mechanical Reasoning	29. Prin. of Accounting
5. Spatial Ability	30. Inorganic Chemistry
6. Applied Mathematics	31. Economic Geography
7. Reading Speed	32. Intro. to Education
8. Vocabulary	33. College English
9. Quantitative Skills (A)	34. Personal Health
10. Quantitative Skills (B)	35. History of Pacific N. W.
11. Quantitative Skills (C)	36. College Algebra
12. Mathematics Achievement	37. Intermediate Algebra
13. High School English	38. Intro. to Philosophy
14. High School Foreign Language	39. Intro. to Psychology
15. High School Mathematics	40. Intro. to Sociology
16. High School Natural Science	41. Intro. to Public Speaking
17. High School Social Science	
18. High School Electives	
19. Sex	
20. Age	

TABLE VIII
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

ART APPRECIATION

Beta

$$X_{26} = -.1663X_6 + -.1554X_7 + .2569X_8 + .2704X_{11} + .0785X_{13}$$
$$+ .2436X_{16} + .2104X_{17}$$

b

$$X_{26} = .6844 + -.0360X_6 + -.2087X_7 + .0141X_8 + .0791X_{11}$$
$$+ .0115X_{13} + .0358X_{16} + .0299X_{17}$$

Pct/Variance

X_6 = -3.774

X_7 = .673

X_8 = 11.430

X_{11} = 10.075

X_{13} = 4.181

X_{16} = 13.231

X_{17} = 11.282

Multiple Correlation

R^2 = .4713

R = .6865

R_c^2 = .4490

R_c = .6700

TABLE IX
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

GENERAL BIOLOGY

Beta

$$X_{27} = .0863X_3 + .0935X_4 + -.1064X_7 + .0836X_8 + -.088X_9 + .1704X_{13} + .0697X_{15} + .0842X_{16} + .3306X_{17} + -.0656X_{19}$$

b

$$X_{27} = -.4348 + .0179X_3 + .0165X_4 + -.0234X_7 + .0059X_8 + -.0356X_9 + .0298X_{13} + .0118X_{15} + .0146X_{16} + .0562X_{17} + -.1716X_{19}$$

Pct/Variance

$X_3 = 3.024$
$X_4 = .979$
$X_7 = .059$
$X_8 = 3.102$
$X_9 = 1.881$
$X_{13} = 9.259$
$X_{15} = 2.987$
$X_{16} = 4.071$
$X_{17} = 19.199$
$X_{19} = -.117$

Multiple Correlation

$R^2 = .4067$
$R = .6377$
$R_c^2 = .389$
$R_c = .6238$

TABLE X
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

INTRODUCTION TO BUSINESS

Beta

$$X_{28} = -.1901X_5 + -.4679X_6 + .2003X_9 + .4730X_{12} + .3273X_{17} + -.2053X_{18} + .1549X_{19}$$

b

$$X_{28} = 2.3712 + -.0356X_5 + -.0790X_6 + .0508X_9 + .0473X_{12} + .0425X_{17} + -.0227X_{18} + .3745X_{19}$$

Pct/Variance

$X_5 = 1.793$

$X_6 = 2.953$

$X_9 = 3.102$

$X_{12} = 8.571$

$X_{17} = 9.228$

$X_{18} = -.008$

$X_{19} = 2.559$

Multiple Correlation

$R^2 = .2823$

$R = .5313$

$R_c^2 = .2283$

$R_c = .4778$

TABLE XI
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

PRINCIPLES OF ACCOUNTING

Beta

$$X_{29} = .2271X_{15} + .1760X_{18} + .1705X_{20}$$

b

$$X_{29} = -.6952 + .0337X_{15} + .0294X_{18} + .0668X_{20}$$

Pct/Variance

$X_{15} = 6.796$

$X_{18} = 4.660$

$X_{20} = 2.462$

Multiple Correlation

$R^2 = .1392$

$R = .3731$

$R_c^2 = .1223$

$R_c = .3497$

TABLE XII
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

INORGANIC CHEMISTRY

Beta

$$X_{30} = -.0929X_2 + -.2039X_5 + .1673X_7 + -.1646X_{11} + .3327X_{12} + .2696X_{15} + .3940X_{16} + .1875X_{20}$$

b

$$X_{30} = -3.9772 + -.0132X_2 + -.0535X_5 + .0337X_7 + -.0517X_{11} + .448X_{12} + .0462X_{15} + .0776X_{16} + .1167X_{20}$$

Pct/Variance

$X_2 = -1.691$

$X_5 = -1.148$

$X_7 = 3.227$

$X_{11} = -2.719$

$X_{12} = 14.262$

$X_{15} = 14.201$

$X_{16} = 21.580$

$X_{20} = 2.424$

Multiple Correlation

$R^2 = .5014$

$R = .7081$

$R_c^2 = .4645$

$R_c = .6815$

TABLE XIII
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

ECONOMIC GEOGRAPHY

Beta

$$X_{31} = .1513X_3 + .1360X_4 + -.1624X_7 + -.1162X_9 + .2913X_{13} + -.2544X_{16} + .1597X_{17} + .1742X_{18}$$

b

$$X_{31} = 1.4273 + .0279X_3 + .0186X_4 + -.0270X_7 + -.0342X_9 + .0423X_{13} + -.0344X_{16} + .0217X_{17} + .02514X_{18}$$

Pct/Variance

$X_3 = 3.234$

$X_4 = 1.048$

$X_7 = 1.529$

$X_9 = -.996$

$X_{13} = 10.170$

$X_{16} = -3.704$

$X_{17} = 5.069$

$X_{18} = 5.213$

Multiple Correlation

$R^2 = .2157$

$R = .4645$

$R_c^2 = .1867$

$R_c = .4321$

TABLE XIV
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

INTRODUCTION TO EDUCATION

Beta

$$X_{32} = .1685X_4 + -.2910X_7 + .3475X_8 + -.1402X_{10} + -.1850X_{14} + .2060X_{16} + .3522X_{17} + .1341X_{19} + .0986X_{20}$$

b

$$X_{32} = .9259 + .0327X_4 + -.0566X_7 + .0228X_8 + -.0291X_{10} + -.0247X_{14} + .02994X_{16} + .0559X_{17} + .3928X_{19} + .0490X_{20}$$

Pct/Variance

$X_4 = 2.198$

$X_7 = 5.522$

$X_8 = 15.280$

$X_{10} = -2.354$

$X_{14} = -3.903$

$X_{16} = 8.371$

$X_{17} = 16.036$

$X_{19} = 2.388$

$X_{20} = .797$

Multiple Correlation

$R^2 = .4435$

$R = .6659$

$R_c^2 = .4003$

$R_c = .6327$

TABLE XV

REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS (Corrected and Uncorrected)

For

COLLEGE ENGLISH

Beta

$$X_{33} = .0912X_1 + -.0882X_3 + -.1156X_6 + .1737X_8 + .0908X_{12} + .3379X_{13} + .0678X_{18} + .0784X_{20}$$

b

$$X_{33} = -.3960 + .0059X_3 + -.0155X_3 + -.0236X_6 + .0101X_8 + .0104X_{12} + .0504X_{13} + .0105X_{18} + .0347X_{20}$$

Pct/Variance

X_1 = 3.414

X_3 = -1.988

X_6 = -1.759

X_8 = 5.806

X_{12} = 1.868

X_{13} = 15.499

X_{18} = 1.996

X_{20} = .240

Multiple Correlation

R^2 = .2508

R = .5008

R_c^2 = .2442

R_c = .4942

TABLE XVI
REGRESSION EQUATIONS (BETA AND bWTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

PERSONAL HEALTH

Beta

$$X_{34} = -.0934X_1 + .0819X_2 + -.0463X_4 + .0524X_5 + .1928X_8 + .1021X_9 + .0617X_{12} + .1521X_{13} + .1110X_{16} + .1200X_{17} + .0856X_{19} + .0509X_{20}$$

b

$$X_{34} = -.0896 + -.0065X_1 + .0108X_2 + -.0072X_4 + .0120X_5 + .0120X_8 + .0345X_9 + .0078X_{12} + .0238X_{13} + .0171X_{16} + .0180X_{17} + .1944X_{19} + .0270X_{20}$$

Pct/Variance

$X_1 = -3.621$

$X_2 = 2.858$

$X_4 = -.106$

$X_5 = .988$

$X_8 = 7.916$

$X_9 = 3.165$

$X_{12} = 1.812$

$X_{13} = 7.150$

$X_{16} = 4.601$

$X_{17} = 5.373$

$X_{19} = 1.383$

$X_{20} = .052$

Multiple Correlation

$R^2 = .3159$

$R = .5620$

$R_c^2 = .3052$

$R_c = .5525$

TABLE XVII
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

HISTORY OF PACIFIC NORTHWEST

Beta

$$X_{35}\ -.118X_1 + -.1542X_2 + .0897X_2 + -.1507X_4 + .1056X_5 + .2063X_8 + -.1325X_{11} + .3567X_{13} + .1035X_{16} + .1301X_{17} + -.1353X_{19}$$

b

$$X_{35}\ \ .1559 + -.0096X_1 + -.0234X_2 + .0208X_3 + -.0302X_4 + .0202X_5 + .0150X_8 + -.0475X_{11} + .0608X_{13} + .0171X_{16} + .0215X_{17} + -.3806X_{19}$$

Pct/Variance

X_1 = -3.027

X_2 = -2.396

X_3 = 2.595

X_4 = .961

X_5 = 1.329

X_8 = 6.573

X_{11} = -.557

X_{13} = 16.566

X_{16} = 4.022

X_{17} = 5.818

X_{19} = -.149

Multiple Correlation

R^2 = .3172

R = .56[illegible]

R_c^2 = .283[illegible]

R_c = .5326

TABLE XVIII
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

COLLEGE ALGEBRA

Beta

$$X_{36} = -.2220X_3 + .0681X_4 + .0995X_7 + -.0623X_8 + -.1859X_{11} + .4885X_{12} + .2400X_{13} + .0797X_{15} + .1619X_{17} + .1982X_{19} + .0524X_{20}$$

b

$$X_{36} = -1.6070 + -.0506X_3 + .0117X_4 + .0220X_7 + -.0049X_8 + -.0618X_{11} + .0752X_{12} + .0479X_{13} + .0145X_{15} + .0280X_{17} + .7520X_{19} + .0315X_{20}$$

Pct/Variance

$X_3 = -2.392$

$X_4 = .675$

$X_7 = .462$

$X_8 = -.979$

$X_{11} = -2.738$

$X_{12} = 22.692$

$X_{13} = 10.943$

$X_{15} = 3.629$

$X_{17} = 6.964$

$X_{19} = 3.413$

$X_{20} = .105$

Multiple Correlation

$R^2 = .4280$

$R = .6542$

$R_c^2 = .4032$

$R_c = .6350$

TABLE XIX
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

INTERMEDIATE ALGEBRA

Beta

$$X_{37} = .3243X_1 + -.1843X_8 + .1978X_{12} + .2431X_{15} + .1962X_{19}$$

b

$$X_{37} = .3236 + .0288X_1 + -.0158X_8 + .0412X_{12} + .0483X_{15} + .6386X_{19}$$

Pct/Variance

$X_1 = 13.689$

$X_8 = -3.524$

$X_{12} = 7.235$

$X_{15} = 11.026$

$X_{19} = 4.390$

Multiple Correlation

$R^2 = .3282$

$R = .5729$

$R_c^2 = .3160$

$R_c = .5621$

TABLE XX
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

INTRODUCTION TO PHILOSOPHY

Beta

$$X_{38} = -.2213X_1 + .2712X_2 + .2365X_3 + -.1851X_5 + -.1765X_7 + .1855X_{12} + -.2350X_{13} + .2236X_{14} + .2820X_{17} + .2047X_{20}$$

b

$$X_{38} = .5148 + -.0155X_1 + .0375X_2 + .0453X_3 + -.0468X_5 + -.0342X_7 + .0221X_{12} + -.0395X_{13} + .0274X_{14} + .0463X_{17} + .0948X_{20}$$

Pct/Variance

$X_1 = -4.181$

$X_2 = 8.695$

$X_3 = 6.369$

$X_5 = .811$

$X_7 = .695$

$X_{12} = 4.082$

$X_{13} = 5.571$

$X_{14} = 7.368$

$X_{17} = 9.219$

$X_{20} = 3.847$

Multiple Correlation

$R^2 = .3137$

$R = .5600$

$R_c^2 = .2518$

$R_c = .5018$

TABLE XXI
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

INTRODUCTION TO PSYCHOLOGY

Beta

$$X_{39} = .0982X_5 + -.0695X_7 + .2419X_8 + .0794X_9 + .1535X_{16} + .2498X_{17}$$

b

$$X_{39} = -.1129 + .0243X_5 + -.0141X_7 + .0156X_8 + .0276X_9 + .0243X_{16} + .0392X_{17}$$

Pct/Variance

$X_5 = 2.589$

$X_7 = -1.141$

$X_8 = 10.881$

$X_9 = 2.695$

$X_{16} = 6.910$

$X_{17} = 12.105$

Multiple Correlations

$R^2 = .3504$

$R = .5919$

$R_c^2 = .3445$

$R_c = .5869$

TABLE XXII
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

INTRODUCTION TO SOCIOLOGY

Beta

$$X_{40} = -.0696X_2 + .1223X_3 + .0864X_5 + -.697X_7 + .2333X_8 + -.1461X_9$$
$$+ .1649X_{13} + .1413X_{16} + .1017X_{17} + .1266X_{18} + -.0538X_{19} + .0645X_{20}$$

b

$$X_{40} = -.4804 + -.0094X_2 + .0244X_3 + .0214X_5 + -.0138X_7 + .0153X_8$$
$$+ -.0522X_9 + .0263X_{13} + .0220X_{16} + .0155X_{17} + .0220X_{18} + -.1503X_{19}$$
$$+ .0317X_{20}$$

Pct/Variances

$X_2 = -1.857$

$X_3 = 4.729$

$X_5 = 1.818$

$X_7 = -.230$

$X_8 = 9.969$

$X_9 = 2.542$

$X_{13} = 7.780$

$X_{16} = 6.289$

$X_{17} = 4.658$

$X_{18} = 4.683$

$X_{19} = -.242$

$X_{20} = .078$

Multiple Correlations

$R^2 = .3514$

$R = .5928$

$R_c^2 = .3329$

$R_c = .5769$

TABLE XXIII
REGRESSION EQUATIONS (BETA AND b WTS.), PERCENTAGE OF VARIANCE AND MULTIPLE CORRELATION COEFFICIENTS
(Corrected and Uncorrected)

For

INTRODUCTION TO PUBLIC SPEAKING

Beta

$$X_{41} = .0973X_5 + -.0647X_8 + .1748X_{10} + -.2168X_{12} + .3827X_{13} + -.0874X_{15} + .1634X_{16} + .1023X_{18} + -.0506X_{19} + .0846X_{20}$$

b

$$X_{41} = -.0721 + .0227X_5 + -.0039X_8 + .0325X_{10} + -.0284X_{12} + .0581X_{13} + -.0133X_{15} + .0235X_{16} + .0161X_{18} + -.1184X_{19} + .0293X_{20}$$

Pct/Variance

$X_5 = 1.350$

$X_8 = -1.212$

$X_{10} = 3.905$

$X_{12} = -2.717$

$X_{13} = 16.715$

$X_{15} = -2.213$

$X_{16} = 6.194$

$X_{18} = 3.449$

$X_{19} = -.326$

$X_{20} = .203$

Multiple Correlation

$R^2 = .2535$

$R = .5035$

$R_c^2 = .2334$

$R_c = .4831$

APPENDIX B

MALE

TABLE XXIV
PERCENTILE TABLE & STANDARD SCORE EQUIVALENT TO DETERMINE PREDICTOR DATA LEVELS AT YAKIMA VALLEY COLLEGE
(Fall, Winter, Spring - '66-'67)

	High School Cumulative Averages						Washington Pre-College Test Results												
	English	Foreign Language	Math	Natural Science	Social Science	Electives	English Composite	Vocabulary	English Usage	Spelling	Reading Speed	Reading Comprehension	Verbal Composite	Quantitative Skills	Applied Math	Math Achievement	Quantitative Composite	Spatial Ability	Mechanical Reasoning
99	3.8	4.0	3.8	3.9	3.9	4.0	71	72	65	70	78	73	72	71	71	71	75	71	75
95	3.3	3.5	3.5	3.5	3.5	3.7	63	63	60	61	72	63	64	65	65	63	68	64	68
90	3.0	3.0	3.0	3.0	3.3	3.5	59	58	58	57	65	59	59	62	62	58	63	61	66
85	2.8	2.8	2.8	2.9	3.0	3.3	56	55	54	55	61	56	57	58	59	55	60	59	63
80	2.7	2.6	2.7	2.7	2.8	3.2	53	53	52	52	59	54	53	57	57	53	57	58	60
75	2.6	2.5	2.5	2.5	2.7	3.1	51	51	50	51	56	53	51	55	55	52	55	56	59
70	2.5	2.4	2.3	2.4	2.6	3.0	49	49	48	49	54	50	49	53	53	51	53	55	56
65	2.3	2.2	2.3	2.3	2.5	2.9	47	48	46	48	54	50	47	52	51	49	51	52	55
60	2.3	2.0	2.2	2.2	2.4	2.8	46	47	45	47	52	48	46	51	50	48	49	51	54
55	2.2	2.0	2.0	2.0	2.3	2.7	44	46	44	46	52	46	45	49	49	47	47	50	52
50	2.2	1.9	1.9	2.0	2.2	2.6	43	45	43	44	50	46	43	48	48	46	46	49	51
45	2.0	1.8	1.8	1.9	2.0	2.5	42	44	42	43	48	45	42	46	47	45	45	47	50
40	2.0	1.7	1.8	1.9	2.0	2.4	41	42	41	42	47	43	41	45	46	44	43	46	48
35	1.9	1.5	1.7	1.8	1.9	2.3	40	41	40	41	45	43	40	44	45	43	42	45	47
30	1.8	1.5	1.6	1.8	1.8	2.2	39	40	39	40	45	42	39	43	44	42	41	43	46
25	1.7	1.4	1.5	1.7	1.8	2.1	37	39	38	39	43	40	37	42	43	41	40	42	44
20	1.7	1.3	1.4	1.5	1.7	2.0	36	38	37	37	43	40	36	40	41	40	38	40	43
15	1.5	1.0	1.3	1.5	1.5	1.9	35	37	35	36	41	39	35	38	39	39	37	37	42
10	1.4	0.9	0.1	1.3	1.4	1.8	33	35	34	34	38	37	33	37	37	38	36	34	39
5	1.2	0.8	0.9	0.9	1.2	1.5	31	33	32	33	34	35	31	34	34	37	34	29	38
1	0.9	0.0	0.8	0.8	0.9	1.0	25	24	28	32	27	34	26	31	31	37	33	27	38

FEMALE

TABLE XXV
PERCENTILE TABLE & STANDARD SCORE EQUIVALENT TO DETERMINE PREDICTOR DATA LEVELS AT YAKIMA VALLEY COLLEGE
(Fall, Winter, Spring - '66-'67)

	High School Cumulative Averages						Washington Pre-College Test Results												
	English	Foreign Language	Math	Natural Science	Social Science	Electives	English Composite	Vocabulary	English Usage	Spelling	Reading Speed	Reading Comprehension	Verbal Composite	Quantitative Skills	Applied Math	Math Achievement	Quantitative Composite	Spatial Ability	Mechanical Reasoning
99	4.0	4.0	3.9	4.0	4.0	4.0	74	72	70	72	76	71	74	66	68	65	71	68	60
95	3.7	3.9	3.5	3.7	3.8	3.8	67	66	65	66	64	64	68	60	61	58	63	62	52
90	3.5	3.5	3.2	3.3	3.5	3.7	64	62	63	62	62	61	64	57	57	54	59	59	50
85	3.3	3.4	2.9	3.0	3.3	3.5	60	59	59	59	59	58	61	55	55	51	56	57	49
80	3.2	3.2	2.8	2.9	3.3	3.4	58	57	58	58	57	56	59	53	53	49	54	55	48
75	3.1	3.0	2.7	2.9	3.2	2.2	56	55	56	56	55	55	56	51	51	47	51	53	46
70	3.0	2.9	2.5	2.8	3.0	3.2	54	53	55	55	54	53	55	51	50	46	49	52	45
65	2.9	2.8	2.5	2.7	2.9	3.1	53	51	53	53	53	51	53	50	49	45	48	50	44
60	2.8	2.5	2.4	2.5	2.8	3.0	51	50	52	52	52	50	52	48	47	45	47	49	43
55	2.8	2.5	2.3	2.5	2.7	3.0	50	49	50	51	51	49	50	47	46	44	45	48	43
50	2.7	2.4	2.2	2.4	2.5	2.9	48	47	49	50	49	47	49	46	45	43	44	47	41
45	2.6	2.3	2.0	2.3	2.5	2.8	47	46	47	49	47	46	47	45	44	43	43	46	40
40	2.5	2.0	1.9	2.0	2.3	2.7	46	45	46	48	46	45	46	44	43	42	42	44	40
35	2.4	2.0	1.9	2.0	2.3	2.6	44	44	46	47	45	44	45	43	42	41	41	43	39
30	2.3	1.9	1.8	1.9	2.2	2.5	43	43	44	46	45	43	43	42	41	40	40	41	39
25	2.2	1.8	1.8	1.9	2.0	2.4	41	41	43	44	44	42	42	40	40	39	38	40	39
20	2.1	1.7	1.6	1.8	2.0	2.3	40	40	41	42	43	40	40	38	39	39	37	39	38
15	2.0	1.4	1.4	1.5	1.8	2.3	38	39	40	41	41	39	38	38	37	38	36	36	38
10	1.8	1.3	1.3	1.4	1.7	2.1	39	36	37	39	39	37	36	36	36	37	35	32	38
5	1.6	1.0	1.0	1.0	1.5	1.9	32	33	34	36	36	35	32	33	33	37	34	28	38
1	1.3	0.8	0.8	0.8	1.0	1.5	25	24	29	32	28	34	26	31	31	37	33	27	38

TOTAL

TABLE XXVI
PERCENTILE TABLE & STANDARD SCORE EQUIVALENT TO DETERMINE PREDICTOR DATA LEVELS AT YAKIMA VALLEY COLLEGE
(Fall, Winter, Spring - '66-'67)

	High School Cumulative Averages						Washington Pre-College Test Results												
	English	Foreign Language	Math	Natural Science	Social Science	Electives	English Composite	Vocabulary	English Usage	Spelling	Reading Speed	Reading Comprehension	Verbal Composite	Quantitative Skills	Applied Math	Math Achievement	Quantitative Composite	Spatial Ability	Mechanical Reasoning
99	3.9	4.0	3.9	3.9	3.9	4.0	73	72	68	71	78	72	73	70	70	71	73	69	74
95	3.5	3.8	3.4	3.5	3.7	3.8	65	64	64	64	69	63	66	65	63	61	66	63	67
90	3.3	3.4	3.0	3.1	3.4	3.6	60	60	59	60	63	60	60	60	61	57	61	61	63
85	3.1	3.0	2.9	3.0	3.2	3.4	57	57	56	57	61	57	58	56	58	54	58	59	60
80	3.0	2.9	2.7	2.9	3.0	3.3	55	55	55	55	59	56	55	56	56	53	55	57	56
75	2.8	2.7	2.5	2.7	2.9	3.2	53	53	53	53	56	54	53	54	54	51	53	55	55
70	2.7	2.5	2.5	2.5	2.8	3.1	51	51	51	52	55	52	51	52	52	49	51	53	52
65	2.6	2.5	2.3	2.5	2.7	3.0	49	50	49	51	54	51	49	51	50	48	49	52	51
60	2.5	2.3	2.2	2.4	2.5	2.9	48	48	48	49	53	49	48	50	49	47	48	50	49
55	2.4	2.1	2.1	2.3	2.4	2.8	46	47	46	48	52	48	46	48	48	45	46	49	48
50	2.3	2.0	2.0	2.0	2.3	2.7	45	46	46	47	50	46	45	47	47	45	45	48	47
45	2.2	2.0	2.0	2.0	2.3	2.6	43	45	44	46	48	45	44	46	46	44	44	47	45
40	2.1	1.9	1.8	1.9	2.2	2.5	42	44	43	44	47	45	42	45	45	43	42	46	44
35	2.0	1.7	1.8	1.9	2.0	2.5	41	42	42	43	46	43	41	44	44	42	41	44	43
30	1.9	1.5	1.7	1.8	2.0	2.4	40	41	41	42	45	43	40	43	43	41	40	43	40
25	1.8	1.5	1.5	1.8	1.8	2.3	38	40	40	41	44	42	38	41	42	40	39	41	40
20	1.7	1.4	1.5	1.6	1.8	2.2	37	39	38	39	43	40	37	40	40	39	38	39	40
15	1.7	1.2	1.4	1.5	1.6	2.0	35	38	37	38	41	39	35	38	38	38	36	37	39
10	1.5	0.9	1.2	1.4	1.5	1.9	33	36	35	37	39	37	33	37	36	37	35	34	38
5	1.3	0.8	0.9	1.0	1.3	1.6	31	34	32	34	35	36	31	34	34	37	34	29	38
1	0.9	0.1	0.8	0.8	0.9	1.2	24	24	28	32	27	34	25	31	31	37	33	27	38

TABLE XXVII
W.P.C.T.
PERCENTILE CHARTS
FOR
HIGH SCHOOL GRADES AND TEST SCORES

PERCENTILE	Average of High School Grades in						Washington Pre-College Test Results														PERCENTILE
	English	Foreign Language	Mathematics	Natural Sciences	Social Studies	Electives	English Composition	Vocabulary	English Usage	Spelling	Reading Speed	Reading Comprehension	Verbal Composite	Quantitative Skills	Applied Mathematics	Mathematics Achievement	Quantitative Composite	Spatial Ability	Mechanical Reasoning	
99	3.9	4.0	3.9	4.0	3.9	3.9	67	69	67	71	76	71	68	66	72	68	65	71	75	99
95	3.4	3.6	3.4	3.5	3.6	3.8	61	61	62	64	67	63	60	60	62	61	59	65	68	95
90	3.1	3.3	3.0	3.1	3.3	3.5	57	57	58	59	61	59	57	57	59	57	56	60	64	90
85	3.0	3.0	2.9	-	3.1	3.4	54	55	55	57	59	56	54	54	57	54	54	58	61	85
80	2.9	2.8	2.6	2.8	3.0	3.3	52	53	53	55	56	54	52	52	55	53	52	56	59	80
75	2.6	2.5	2.5	2.6	2.9	3.1	50	51	52	52	54	53	50	51	53	51	51	-	57	75
70	2.5	2.4	2.4	2.5	2.6	3.0	49	50	50	50	-	51	49	50	51	49	49	53	55	70
65	-	2.3	2.3	2.4	2.5	-	47	49	48	49	52	50	47	48	49	47	48	51	53	65
60	2.4	2.1	2.1	2.3	-	2.9	46	48	47	48	50	48	46	47	-	46	47	-	52	60
55	2.3	2.0	2.0	2.1	2.4	2.8	45	47	46	47	-	-	45	46	47	-	46	49	51	55
50	2.1	-	-	2.0	2.3	2.6	44	46	44	46	48	46	44	45	46	45	45	-	49	50
45	2.0	-	-	-	2.1	2.5	43	45	43	44	47	45	43	44	-	44	44	47	48	45
40	-	1.7	1.7	-	2.0	-	42	44	42	43	45	-	42	43	44	43	-	-	47	40
35	-	-	-	-	-	2.4	41	43	41	42	-	43	41	42	-	42	43	45	-	35
30	1.9	1.5	-	1.7	1.9	2.3	40	42	40	41	43	42	40	41	42	41	42	42	45	30
25	1.7	-	1.5	-	1.7	2.1	39	41	38	40	41	-	39	40	40	-	41	-	44	25
20	1.5	1.4	1.4	1.5	-	2.0	37	40	37	39	39	40	37	39	-	40	40	40	43	20
15	-	1.2	1.2	1.4	1.5	-	36	38	36	38	38	39	36	38	38	39	39	38	42	15
10	1.4	1.0	-	1.2	1.4	1.9	35	37	34	37	36	37	35	37	36	-	38	36	40	10
5	1.2	-	1.0	1.0	1.0	1.5	33	35	32	34	32	36	33	35	34	38	37	31	39	5
1	1.0	0.5	0.6	0.8	0.8	1.2	30	31	29	33	27	-	30	32	33	37	35	29	-	1

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TABLE XXVIII
W.P.C.T.
PERCENTILE CHARTS
FOR
HIGH SCHOOL GRADES AND TEST SCORES

PERCENTILE	Average of High School Grades in						Washington Pre-College Test Results													PERCENTILE
	English	Foreign Language	Mathematics	Natural Sciences	Social Studies	Electives	English Composition	Vocabulary	English Usage	Spelling	Reading Speed	Reading Comprehension	Verbal Composite	Quantitative Skills	Applied Mathematics	Mathematics Achievement	Quantitative Composite	Spatial Ability	Mechanical Reasoning	
99	-	-	4.0	-	-	-	73	73	71	76	78	77	73	74	76	74	75	73	76	99
95	4.0	4.0	3.9	4.0	4.0	4.0	67	68	67	68	68	70	67	67	68	69	69	67	69	95
90	3.7	3.8	3.6	3.7	3.8	3.9	63	64	64	65	65	65	63	64	64	66	65	65	65	90
85	3.5	3.6	3.4	3.5	3.6	3.8	61	61	62	61	61	62	61	61	62	62	62	62	63	85
80	3.4	3.4	3.2	3.3	3.5	3.6	58	59	59	59	59	59	58	59	59	59	59	60	60	80
75	3.3	3.1	3.0	3.1	3.3	3.5	57	57	58	57	56	56	57	57	-	56	57	58	57	75
70	3.1	-	2.9	3.0	3.2	3.4	55	55	56	56	-	-	55	55	55	54	55	56	55	70
65	-	3.0	2.8	-	3.1	3.3	53	53	54	53	54	54	54	53	-	53	53	-	53	65
60	3.0	2.8	2.6	2.8	3.0	-	52	52	53	52	-	53	52	52	53	51	51	53	52	60
55	2.9	2.6	2.5	2.7	2.9	3.1	50	50	51	51	52	51	50	51	51	49	50	-	51	55
50	2.7	2.5	2.4	2.6	2.8	3.0	49	49	50	50	50	50	49	49	49	48	48	51	58	50
45	2.6	2.4	2.3	2.5	2.7	-	48	48	48	48	48	48	48	48	-	47	47	-	47	45
40	2.5	2.3	2.2	2.4	2.6	2.9	46	46	47	47	47	46	47	46	47	46	46	49	45	40
35	2.4	2.1	2.1	2.2	2.4	2.8	45	45	46	46	-	45	45	45	46	44	44	47	44	35
30	2.3	2.0	2.0	2.1	2.3	2.7	44	44	44	44	45	-	44	44	-	43	43	45	-	30
25	2.1	1.9	1.9	2.0	2.2	2.6	43	42	43	43	43	43	43	43	44	42	42	42	43	25
20	2.0	1.8	1.8	-	2.1	2.5	41	41	41	41	-	42	41	41	42	41	41	-	42	20
15	1.9	1.6	1.6	1.8	1.9	2.3	39	49	39	40	41	39	39	40	40	40	40	40	39	15
10	1.7	1.4	1.5	1.6	1.8	2.1	37	38	37	38	39	39	37	37	38	38	38	38	-	10
5	1.5	1.1	1.3	1.3	1.5	2.0	34	35	35	36	36	36	35	34	36	37	36	34	-	5
1	1.1	0.6	0.9	1.0	1.1	1.4	30	30	29	33	26	-	31	31	33	-	34	29	-	1

ALL COLLEGE STUDENTS

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TABLE XXIX
THE STANDARD ERROR OF ESTIMATE AND ASSOCIATE STATISTICS OF THE WASHINGTON PRE-COLLEGE TESTING PROGRAM

Course Area	N	Standard Error of Estimate	Validity Coefficient	Mean Grade Point of Criterion	Standard Deviation of Criterion's Grade Point
ALL COLLEGE	5888	.57	.65	2.16	.75
Accounting	1117	.84	.55	1.96	1.00
*Agriculture	216	.79	.40	2.07	1.10
Anthropology	1752	.84	.52	2.20	.98
*Auto Mechanics	119	.78	.51	2.24	.91
**Biology, Introductory	316	.75	.71	1.91	1.05
Botany	430	.81	.67	2.16	1.10
Business Administration	1671	.78	.57	2.30	.94
**Chemistry, Introductory	2096	.82	.59	1.88	1.02
Communications: Principles	531	.80	.42	2.75	.88
*Data Processing	330	.95	.35	2.48	1.01
Economics, Advanced	264	.74	.40	2.73	.81
**Economics, Introductory	2151	.83	.52	2.00	.97
*Electronics	188	.96	.45	2.04	1.08
Engineering, Introductory	2139	.64	.56	2.19	.77
*Engineering Technology	334	.91	.46	2.22	1.02
**English, Freshman	4754	.60	.63	2.23	.77
English Composition	239	.71	.35	2.59	.76
English Literature	1566	.68	.45	2.41	.76
Forestry	232	.69	.48	2.14	.78
French, Introductory	631	.78	.66	2.44	1.04
Geography	869	.83	.46	2.34	.93
German, Introductory	587	.81	.64	2.42	1.05
History	745	.80	.48	2.39	.92
Home Economics	578	.63	.42	2.71	.69
**Mathematics: Algebra	2546	.87	.54	2.03	1.04
Mathematics: Calculus	1278	.85	.47	2.01	.96
Microbiology	226	.87	.43	2.48	.97
Music Theory	208	.59	.70	2.53	.83
Nursing: Practices	291	.67	.36	2.85	.72
Nursing: Principles	344	.66	.45	2.70	.74
Nutrition	574	.67	.50	2.49	.77
Philosophy	728	.82	.49	2.32	.94
Physical Education Theory	293	.64	.53	2.84	.76
Physics	1291	.75	.45	2.30	.84
Political Science	1068	.70	.50	2.38	.81
**Psychology, Introductory	2505	.80	.56	2.22	.96
Russian, Introductory	188	.90	.44	2.57	1.00
*Secretarial Studies	1443	.91	.50	2.16	1.05
**Sociology, Introductory	2596	.80	.61	2.11	1.01
Spanish, Introductory	397	.83	.69	2.32	1.16
Speech	1877	.67	.47	2.50	.76
*Welding	260	.85	.44	2.27	.95
Zoology	924	.83	.56	2.13	1.00

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*Community College Programs

**Criterion areas included in Table III

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TABLE XXX
MEASURES OF CENTRAL TENDENCY & ASSOCIATE STATISTICS TO DETERMINE PREDICTOR DATA LEVELS FOR Males at Yakima Valley College ('66-'67)

Variable	Mean	Median	Mode	Range	Semi-Interquartile Range
Composite English Total	44.63	43.30	40	76-24	5.74
Vocabulary	40.25	38.30	29	98-0	10.41
English Usage	30.07	27.91	27	80-0	9.74
Spelling	12.20	11.14	10	43-0	5.46
Reading Speed	25.61	25.66	27	40-6	3.40
Reading Comp.	8.74	7.94	7	34-0	3.67
Composite Verbal	44.63	43.38	41	76-26	5.81
Quant A.	6.01	6.19	7	13-0	2.40
Quant B.	12.45	12.42	13	29-0	4.20
Quant C.	4.30	3.31	0	15-0	2.70
Quant Combined (A,B,C)	22.92	22.16	17	54-0	7.55
Applied Math	9.93	9.66	10	27-0	3.29
Math Ach.	12.31	10.81	0	43-0	6.08
Composite Quant.	48.25	47.48	48	78-33	5.82
Spatial Ability	9.81	9.93	9	23-0	3.18
Mech. Reasoning	11.02	10.37	10	32-0	5.50
H. S. English	21.78	21.42	20	40-7	4.41
H. S. Foreign Language	19.53	19.61	20	40-0	5.74
H. S. Math	20.52	19.74	20	40-5	4.98
H. S. Natural Science	21.43	19.93	20	40-5	3.94
H. S. Social Science	22.81	22.54	20	40-8	4.94
H. S. Electives	26.48	26.32	30	40-0	4.78
H. S. Overall G.P.A.	18.23	21.05	0	39-0	4.53
All University	17.23	16.78	15	32-8	2.58
Sex	.00	.25	0	0-0	.12
Average	17.32	17.21	17	25-0	.48

TABLE XXXI

MEASURES OF CENTRAL TENDENCY & ASSOCIATE STATISTICS TO DETERMINE PREDICTOR DATA LEVELS FOR Females at Yakima Valley College ('66-'67)

Variable	Mean	Median	Mode	Range	Semi-Interquartile Range
Composite English Total	49.03	48.94	49	78-25	6.71
Vocabulary	44.60	43.38	37	95-0	12.21
English Usage	38.19	37.28	35	77-1	11.04
Spelling	16.21	15.81	20	47-0	5.47
Reading Speed	24.72	24.46	27	40-0	2.90
Reading Comp.	9.31	8.76	7	28-0	4.21
Composite Verbal	49.11	48.95	50	78-26	6.69
Quant A.	5.49	5.32	7	14-0	2.15
Quant B.	10.33	10.60	11	27-0	3.94
Quant C.	3.92	3.25	0	15-0	2.40
Quant Combined (A,B,C)	19.87	19.50	19	52-0	6.52
Applied Math	8.25	7.75	7	24-0	3.19
Math Ach.	8.88	7.26	0	44-0	4.56
Composite Quant.	45.92	45.30	50	72-33	5.06
Spatial Ability	8.88	9.00	8	21-0	3.06
Mech. Reasoning	3.98	2.86	0	25-0	3.09
H. S. English	26.88	27.21	30	40-10	4.72
H. S. Foreign Language	24.45	24.66	20	40-0	5.89
H. S. Math	22.53	22.44	20	40-5	4.86
H. S. Natural Science	24.14	24.60	20	40-8	5.13
H. S. Social Science	26.18	25.41	28	40-8	5.76
H. S. Electives	28.98	29.28	30	40-10	4.41
H. S. Overall G.P.A.	21.48	24.18	0	40-0	5.13
All University	20.34	20.24	24	33-10	3.35
Sex	1.00	1.00	200	2-1	0.25
Average	17.58	17.13	17	25-0	0.33

TABLE XXXII
MEASURES OF CENTRAL TENDENCY & ASSOCIATE STATISTICS TO DETERMINE PREDICTOR DATA LEVELS FOR Total Group at Yakima Valley College ('66-'67)

Variable	Mean	Median	Mode	Range	Semi-Interquartile Range
Composite English Total	46.35	45.51	40	78-24	6.44
Vocabulary	41.95	39.94	37	98-0	11.40
English Usage	33.24	31.56	28	80-0	11.03
Spelling	13.78	13.07	11	47-0	5.71
Reading Speed	25.26	25.25	27	40-0	3.17
Reading Comp.	8.96	8.28	7	34-0	3.87
Composite Verbal	46.39	45.39	41	78-26	6.44
Quant A.	5.80	5.77	7	14-0	2.30
Quant B.	11.62	11.61	13	29-0	4.07
Quant C.	4.15	3.29	0	15-0	2.60
Quant Combined (A,B,C)	21.70	21.03	20	54-0	7.18
Applied Math	9.28	8.92	7	27-0	3.29
Math Ach.	10.97	9.21	0	44-0	5.71
Composite Quant.	47.34	46.65	47	78-33	5.61
Spatial Ability	9.44	9.52	9	23-0	3.12
Mech. Reasoning	8.29	7.06	0	32-0	5.41
H. S. English	23.80	23.03	20	40-7	5.00
H. S. Foreign Language	21.58	20.22	20	40-0	6.40
H. S. Math	21.31	20.16	20	40-5	5.03
H. S. Natural Science	22.50	20.38	20	40-5	4.74
H. S. Social Science	20.15	23.36	20	40-8	5.74
H. S. Electives	27.48	27.67	30	40-0	4.77
H. S. Overall G.P.A.	19.53	22.11	0	40-0	4.86
All University	18.46	17.97	15	33-8	3.21
Sex	0.39	0.41	0	2-0	0.33
Average	17.42	17.17	17	25-0	0.41

TABLE XXXIII
ASSOCIATE STATISTICS TO COMPUTE MALE PERCENTILE TABLES AT YAKIMA VALLEY COLLEGE

Variable	N	Mean	S.D.	Variance	S.E. Skewness	Skewness
Composite English Total	1022	30.07	14.37	206.612	.555	.076
Vocabulary	1011	12.20	7.76	60.321	.683	.077
English Usage	1013	8.74	5.64	31.820	.890	.077
Spelling	1015	11.02	7.14	51.050	.387	.076
Reading Speed	1015	9.81	4.62	21.400	-.155	.076
Reading Comp.	1021	9.93	4.89	23.980	.290	.076
Composite Verbal	1022	25.61	5.92	35.090	.280	.076
Quant A.	1020	40.25	16.59	275.430	.544	.076
Quant B.	1012	6.01	3.21	10.360	.037	.077
Quant C.	1020	12.45	5.86	34.380	.067	.076
Quant Combined (A,B,C)	1000	4.30	3.68	13.560	.773	.077
Applied Math	1019	12.31	9.05	81.930	.852	.076
Math Ach.	817	18.23	10.28	105.790	-.784	.085
Composite Quant.	982	21.78	6.28	39.540	.402	.078
Spatial Ability	825	19.53	8.39	70.480	.361	.085
Mech. Reasoning	982	20.52	7.10	50.520	.574	.078
H. S. English	974	21.43	6.90	47.670	.409	.078
H. S. Foreign Language	983	22.81	7.01	49.190	.362	.078
H. S. Math	957	26.48	6.68	44.680	-.121	.079
H. S. Natural Science	1022	48.25	8.18	67.030	.537	.076
H. S. Social Science	1022	44.63	8.62	74.410	.641	.076
H. S. Electives	1022	44.63	8.69	75.620	.648	.076
H. S. Overall G.P.A.	983	17.23	4.15	17.230	.606	.078
All University	1022	0.00	0.00	0.000	.000	.076
Sex	1022	17.32	2.99	8.980	-3.290	.076
Average	991	22.92	10.65	113.510	.276	.077

TABLE XXXIV
ASSOCIATE STATISTICS TO COMPUTE FEMALE PERCENTILE TABLES AT YAKIMA VALLEY COLLEGE

Variable	N	Mean	S.D.	Variance	Skewness	S.E. Skewness
Composite English Total	656	38.19	15.69	246.360	.078	.095
Vocabulary	656	16.21	8.13	66.156	.351	.095
English Usage	654	9.31	5.70	32.511	.446	.095
Spelling	641	3.98	4.10	16.843	1.257	.096
Reading Speed	652	8.88	4.40	19.402	-.075	.095
Reading Comp.	654	8.25	4.54	20.697	.418	.095
Composite Verbal	656	24.72	5.09	25.928	.097	.095
Quant A.	655	44.60	18.05	325.998	.166	.095
Quant B.	651	5.49	2.97	8.842	.122	.096
Quant C.	653	10.34	5.21	27.173	.037	.095
Quant Combined (A,B,C)	638	3.92	3.37	11.364	.826	.097
Applied Math	649	8.88	7.44	55.357	1.266	.096
Math Ach.	544	21.48	11.09	123.091	-.966	.105
Composite Quant.	642	26.88	6.39	40.897	-.014	.096
Spatial Ability	592	24.45	8.28	68.670	.088	.100
Mech. Reasoning	641	22.53	7.10	50.529	.257	.096
H. S. English	637	24.14	7.27	52.908	.148	.097
H. S. Foreign Language	642	26.18	7.04	49.623	.029	.096
H. S. Math	639	28.98	5.96	35.550	-.169	.096
H. S. Natural Science	656	45.92	7.22	52.144	.568	.095
H. S. Social Science	656	49.11	9.40	88.418	.151	.095
H. S. Electives	656	49.03	9.48	89.955	.144	.095
H. S. Overall G.P.A.	642	20.34	4.46	19.956	.098	.096
All University	656	1.00	0.00	0.000	.000	.095
Sex	656	17.58	1.92	3.705	1.691	.095
Average	634	19.87	9.40	88.464	.275	.097

TABLE XXXV
ASSOCIATE STATISTICS TO COMPUTE TOTAL PERCENTILE TABLES AT YAKIMA VALLEY COLLEGE

Variable	N	Mean	S.D.	Variance	Skewness	S.E. Skewness
Composite English Total	1678	33.24	15.42	237.851	.376	.059
Vocabulary	1667	13.78	8.15	66.461	.532	.060
English Usage	1667	8.96	5.67	32.170	.712	.060
Spelling	1656	8.29	7.03	49.542	.782	.060
Reading Speed	1667	9.44	4.56	20.824	-.111	.060
Reading Comp.	1675	9.28	4.83	23.370	.353	.059
Composite Verbal	1678	25.26	5.63	31.696	.259	.059
Quant A.	1675	41.95	17.31	299.701	.397	.059
Quant B.	1663	5.81	3.13	9.832	.083	.060
Quant C.	1673	11.62	5.71	32.631	.111	.059
Quant Combined (A,B,C)	1638	4.15	3.56	12.742	.803	.060
Applied Math	1668	10.97	8.62	74.392	1.016	.060
Math Ach.	1361	19.53	19.73	115.239	-.806	.066
Composite Quant.	1624	23.80	6.80	46.299	.224	.060
Spatial Ability	1417	21.58	8.69	75.622	.218	.065
Mech. Reasoning	1623	12.31	7.17	51.496	.437	.060
H. S. English	1611	22.50	7.17	51.500	.311	.061
H. S. Foreign Language	1625	24.15	7.21	52.078	.220	.060
H. S. Math	1596	27.48	6.52	42.534	-.186	.061
H. S. Natural Science	1678	47.34	7.90	62.509	.582	.059
H. S. Social Science	1678	46.39	9.20	84.663	.448	.059
H. S. Electives	1678	46.35	9.26	85.847	.449	.059
H. S. Overall G.P.A.	1625	18.46	4.54	20.629	.398	.060
All University	1678	0.39	0.48	0.238	.447	.598
Sex	1678	17.42	2.63	6.938	-2.750	.059
Average	1625	21.73	10.29	105.942	.318	.060

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